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The Growth of U. S. Naval Cadets.

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The study of the growth and the development of the human subject has always been one of great interest, not only to the physiologist and statistician, but also to the general reader. While, however, growth seems to be the most natural thing that occurs in the animate world and in living things, some of the mysterious laws that govern the process are still involved in obscurity.

One of the means for the study of *human* development is anthropometry. By it we are enabled to record the progress that has been made in the different dimensions from time to time, and, providing our material is sufficiently large, to form our conclusions accordingly.

Thus it has been the custom at the Naval Academy for the last thirty years or more to make an annual physical examination of every cadet in training at that school, and, at the same time, to keep a record of certain anthropometric measurements of every cadet undergoing such examination. As the material that has accumulated in this manner is now sufficiently large, it would seem as if it were a duty to attempt a systematic study of these valuable records, with the view of contributing something to our present knowledge of the subject of growth.

As regards the nature of the examination itself, it is well known to all interested in the subject of anthropometry from the items that are recorded, and needs, therefore, not be described in detail. Up to a few years ago the height standing, perineal height, circumference of chest, waist measure and the lung capacity were the only items recorded. Within recent years the height sitting, span of arms, strength of squeeze, acuteness of vision and hearing have been added to these records. The number of observations under the first-named items is, consequently, much larger than that under the last named.

The fact that all the measurements are taken and recorded by medical men is sufficient guarantee of their accuracy and adds no little value to the results we may derive from them.

The cadet who stays the full term of four years at this school leaves on the books the records of five successive examinations taken one year apart; after graduation two years are spent at sea, after which time the cadet returns to the Academy for his final examination, leaving the records of another physical examination. This makes six in all. Since the age for entrance into the Academy is limited to from 15 to 18 years, and taking six years as the time necessary to elapse between the first and last examinations, the period of growth covered by these records ranges all the way from 15 to 24 years of age.

The circumstance that the cadets for the Naval Academy are appointed from all parts of the United States by their representatives in Congress ought, in our opinion, to add considerable weight in our attaching to whatever means or averages we may derive from their measurements a certain value, more national in character than can be attributed to the means and averages derived from the measurements of merely local schools and colleges. Besides, another point that is calculated to make our records particularly valuable is the fact that a large percentage of them are continuous records. The number of cadets that enter annually may be said to have varied in the past between 60 and 80, and that of those who graduate between 30 and 40.

It is perhaps also of some importance to mention the fact at the beginning that, from the great preponderance of blue eyes and light brown hair prevailing among Naval Cadets, it is safe to state that the great majority of them are of Anglo-Saxon and Teutonic origin. It is not impossible that the school may have exercised and is still exercising a certain degree of selection from that type of men for its devotees.

Statistical Methods.

One of the greatest impediments to our progress in the study of growth in this country has undoubtedly been due to the fact that different observers have used different methods of recording the results of their investigations, and, consequently, these results are difficult of comparison.

As regards the methods of investigation used in the present inquiry and those of recording its results, I have adhered to those used by Prof. W. T. Porter in his work on the "Growth of St. Louis Children" as closely as possible and with the view of making my statistics strictly comparable to his.

A brief outline of these methods and our conception of them seems, therefore, essential.

Based on Quetelet's statements made many years ago, it has since been most generally assumed that all anthropometric measurements would be found distributed according to the laws of chance; that a large number of measurements, for instance, of the height of man would arrange themselves on either side of a true height. It has, furthermore, been assumed that this arrangement would be symmetrical on either side of the true height if the number of observations were infinite and if only accidental influences had been at work in each individual measurement in a given series.

Quetelet's theory has since been further developed by Stieda and Ihring and also by Galton. In the same manner Bowditch and Porter have adhered to the theory of Quetelet, and all their investigations are based on this theory.

Quite recently Boas has made the following remarks regarding the theory of Quetelet, viz : "Glancing over the curves representing large series of measurements, it strikes me that they conform to the laws of chance only in a general way and that considerable deviations occur quite frequently. . . . Assuming that there is a uniform ancestral type in a certain district, and that the conditions of life remain stable, we may expect that the people representing its offspring will be grouped around the type according to the laws of chance. Assuming, however, that there were two distinct ancestral types in adjoining districts, and that these types intermingled, we cannot foretell what the distribution of forms among the offspring will be. It may be that they will represent an intermediate type between the parental forms, in which case we might expect to find them distributed according to the laws of chance. But it might also be that they showed a tendency to reproduce one or the other of the ancestral types either pure or slightly modified, in which case the resulting curve would not conform to the laws of chance, but would show an entirely different character."

This view seems to be well taken and deserves our consideration all the more for the reason that the intermingling of different varieties of the same species is a well-known cause for variation. In view of cautionary signals such as the above, some comfort may perhaps be derived concerning our present material of observation from the fact above mentioned, that the preponderating racial type of man under investigation is undoubtedly Teutonic in character. At any rate, a sorting out of types different from the prevailing one being entirely out of the question, especially in the absence of all craniometric data, we have been obliged to follow the example of previous investigators, and will make a brief statement of the various methods employed in the present inquiry, hoping that whatever correction may have to be applied may apply to all alike in the future.

In Table I* are exhibited the observed distributions of the heights of 842 Naval Cadets aged eighteen years.

Average.—The average (A) was calculated according to Stieda, quoted by Porter, and which means the quotient obtained by dividing the sum (Σa) of the values (a) obtained in the individual measurements by the whole number of observations (n) : $A = \frac{\Sigma a}{n}$. The adjoining Table II will illustrate the method.

Mean or Median Value (M) can sometimes be found by the simple inspection of a series, if the number of observations is sufficiently large, but is more exactly determined by the following method, viz : The mean strength of squeeze of the right hand in Table II is obtained by adding the number of observations from above downwards until the sum cannot be increased by the next number in the column without exceeding half the total number of observations. Thus 111 is reached opposite 75 pounds; the next number below in the column (40) would make the sum 151, which is more than half (112.5) of the total number of observations (225). The mean is, therefore, greater than 75 but less than 80 pounds. Its exact position is found by interpolation. Half of the total number of observations is 112.5, which is 1.5 more than the observations up to 75 pounds; 1.5 is 3.7 per cent of 40, the observations at 80 pounds. Hence the mean is 75.46.

* The tables referred to will be found in the Appendix.

Some statisticians take the average to be the nearest approach to the typical value, and this seems to be the case whenever the distribution of measurements follows the laws of chance; others look upon the mean to be the better value as representing the type, while still others hold that neither of these values in their present application represents the true type. Bowditch says: "If A represent the average value of all the observations, then the value of $M—A$ will be a measure of the direction and extent of the asymmetry of the curve ST (curve of percentile grades), for this value will be zero when the curve is symmetrical, positive when the values of the lower percentile grades fall short of M more than those at the higher grades exceed it, and negative when the reverse is the case." An examination of his table and of the curves constructed from it shows that the asymmetry of the curves of percentile grades varies very much at different ages both in direction and amount. Bowditch states distinctly that "we must conclude, therefore, that the rate of annual increase, both in height and weight, is different at different percentile grades, or, in other words, that large children grow differently from small ones, and, moreover, that between the ages of eleven and fifteen years there is a striking difference in the mode of growth between the two sexes." We will refer to this point of the difference in the growth between tall and small children in some detail later on.

THE PROBABLE DEVIATION.—But neither average nor mean gives us any information as regards the manner in which the individual measurements of a series are distributed, and it is clear that two series with an identical mean or average may yet differ largely in respect of the dispersion of the individuals from the middle value, as the following numbers, taken from Porter, will show:

4, 5, 6, 14, 15, 16.
9, 9, 10, 10, 11, 11.

These have the same average (10).

A very convenient measure of the degree of dispersion or deviation of the individual members of a series from their common mean or average is that afforded by the "probable deviation."

Probable deviation (d) is that deviation from the middle value which, in a large series of observations, is as often exceeded as attained (Lexis, Porter). According to Boas, the *mean deviation* is more accurate than the probable deviation, which is no doubt true. Inasmuch, however, as the relation between the two must be constant, and as it was one of our objects to make the results of our investigations comparable with those of previous investigators, the preference was given to the probable deviation which was calculated in accordance with the following approximation formula:

$$d = \pm 0.8453 \frac{\Sigma\delta}{n}.$$

In accordance with this formula all the individual deviations from the middle value (average or mean) of a series must be added together without regard to whether they be plus or minus, and the sum divided by the total number of observations as shown in Table III.

The observed distribution shown in Table III must now be compared with the distribution of the observations of an hypothetical series constructed according to the calculus of probabilities. The observed and the theoretical series should correspond, providing the causes of the deviations are purely accidental. Since it is absolutely required that such a comparison must be made before it can be known whether the observations in any series can be treated by the methods of the theory of probabilities, Table IV is appended.

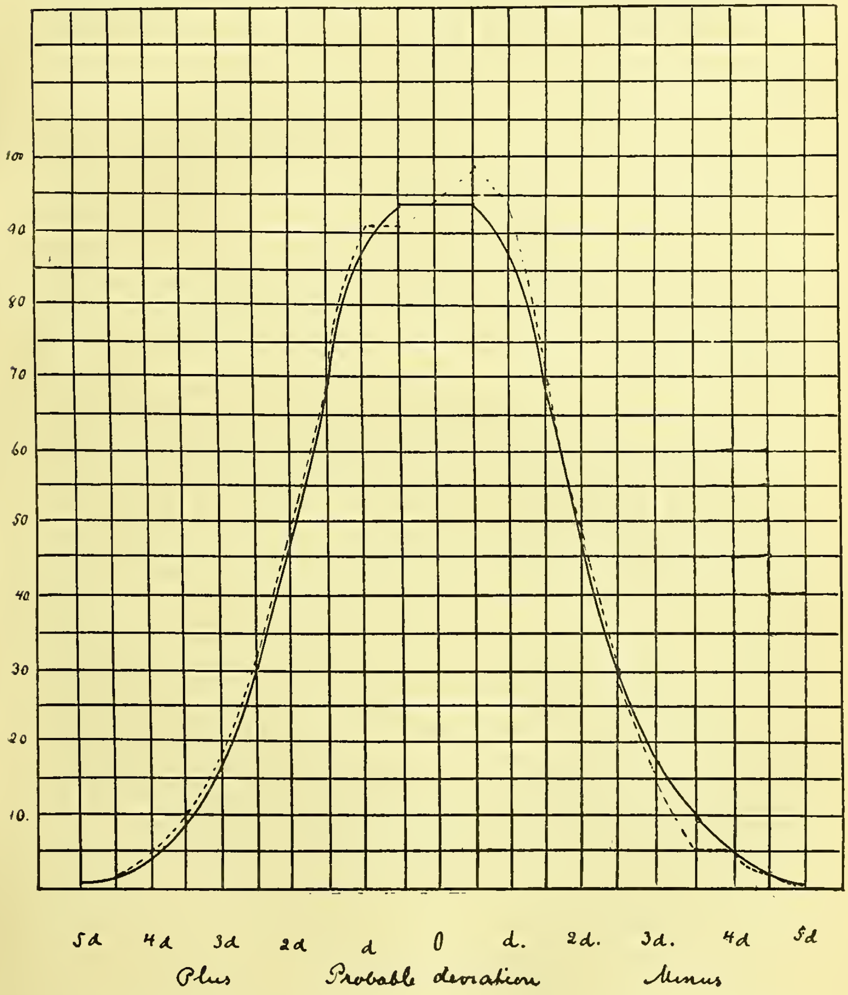
This table apparently shows that slight deviations do occur, and Bertillon proved this some time ago. Bowditch, also, has shown that the curves, showing the distribution of statures and weights of children, do not follow the laws of chance, by having pointed out the fact that during the period of growth a constant difference exists between the average and the probable values, an observation which we have also been able to confirm, as will be seen later on.

In the preparation of Table IV, Stieda's table, reproduced by Porter, and shown as Table V, has been made use of.

In order to bring out the relation between the theoretical and the observed observations still more clearly, Fig. 1 is appended, which is a graphic representation of Table IV. It is perhaps rather remarkable that the deviations of the observed from the theoretical curve are greatest about the mean, just where the numbers are largest and where, therefore, the agreement should be expected to be the closest.

FIG. 1.

The Calculated and Observed Distribution of the Height of 722 Naval Cadets aged 17.
Unbroken line: according to theory. Broken line: according to observation.



PERCENTILE GRADES.—Another method for calculating the distribution of the observations in a series is the percentile method of Galton. According to this method the distribution of the observations is determined at intervals of 5 or 10 per cent from the median value.

Table VI shows the percentile distribution of 841 Naval Cadets aged 18 years according to this method.

Perhaps the simplest and, at the same time, the truest means for showing the distribution of, for instance, the height (or any other dimension) in a given series would be to arrange the members according to increasing height at intervals of, say, one-half inch, expressing in numbers the members found between every half inch.

THE PROBABLE ERROR (E) of the average was determined by the formula $E = \pm \frac{d}{\sqrt{n}}$ (Stieda, Porter),

where $E =$ the probable error of average,

$d =$ probable deviation of an individual from the average,

$n =$ number of observations in the series.

Table VII represents the values E as calculated according to this formula.

As was mentioned before, for the sake of uniformity and easy comparison, we have, in the preparation and tabulation of our material, adhered as closely as it was possible to the methods used by Porter. The period of growth covered by our tables is from 15 to 24 years of age, or, practically, to the termination of the growing period, although rare instances have occurred in which growth has been noted to have taken place even later. But such instances as these are extremely rare and can scarcely be called the rule. The tables of both Bowditch and Porter practically stop at the age of 16 years, for males at least, because their numbers after that age are very small and therefore not so reliable as those of the preceding ages. It seemed, therefore, that the material at our disposal might in a way be well calculated to complement theirs, and for this reason, if for no other, it would be very desirable to tabulate it so as to make them both in all respects comparable. We have, accordingly, calculated for every year here represented the average and the mean, the median minus average values, the probable deviations and the probable errors, as well as the 5, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 95 percentile grades. The 25th and 75th percentile grades, given in some of the tables, were obtained by dividing by two the sums of the 30th and 20th and of the 80th and 70th percentile grades respectively.

Averages; Means; Median minus Average Values; Probable Deviations.

These values are shown in Tables VIII, IX, X, and XI, and a brief discussion of them seems now in order.

According to Porter, "the mean or average of the observations at any age in the period of growth is typical of the child at that age, and a comparison of the means at different ages will reveal the law of growth of the type. Again, the mean of the observations at any deviation from the mean of the whole number, for example of the height at a deviation of $+d$ from the mean, or, if Galton's method be employed, the height at any percentile grade, is the type of those who stand at a certain degree of deviation from the type of the whole number. Thus the types of tall and short, light and heavy children are secured. The types of the same degree of deviation from the mean at all ages are as comparable as the type of the whole number of observations, and reveal the growth of the typically tall and short, light and heavy children; but the comparison is less secure the greater the deviation from the mean, for the probable error is inversely as the square of the number of observations, and the number of observations rapidly diminishes on either side of the mean."

This beautiful conception regarding the theory of the growth of tall and short children, however, has been quite recently most severely criticized by Boas in "Science." Boas expresses himself as follows: "We know of a number of facts which show plainly that the assumption is incorrect. It has been shown in Dr. Bowditch's tables that Irish children are shorter than American children. If the position of the American child is expressed in percentile grades of the whole Boston series and that of the Irish child in the same manner, it will be seen at once that they diverge more and more with increasing age. Pagliani's measurements of Italian children and my own of Indian tribes of different statures bring out the same point still more strongly."

Under these circumstances it would seem, perhaps, the safer plan to look upon the averages and the means not as the types themselves, but merely as the indices to the true types.

A mere glance at the tables of the averages and means shows at once that development and growth from year to year is anything but uniform and regular.

The praepubertal acceleration of growth in height, at first fully established by Bowditch and later on confirmed by Kotelmann, Roberts, Erismann and Porter, is also well shown in our tables.

According to Erismann, the period of accelerated growth, beginning with the advent of puberty and ending with the full establishment of sexual maturity, is completed at age 18.

We would add that a period of *retarded* growth follows immediately upon that of accelerated growth, after which period the curve again gradually makes a more rapid ascent towards the completion of the intended height. From age 20 growth is exceedingly slow. This fact is well illustrated in Table XII, in which, for the sake of comparison, I have added my own figures and those given by Porter to a table taken from Erismann.

In all the tables given here the ages have been calculated from the nearest birthday and not from the last birthday. The years, therefore, do not in all cases indicate the absolute age to which these figures belong, on account of the unequal distribution of the numbers within each year, that is to say, as the numbers between 15 and 16 years of age increase there must be a larger number of individuals between 15 and 15½ years than between 14½ and 15 years, so that the average age must be slightly higher than 15. The reverse must be the case, of course, when the numbers begin to decrease.

In connection with our averages and means, the measurements of Gould, taken during the war of secession, of a great many thousands of soldiers of different nationalities, are of some interest. The ages of the soldiers ranged between 31 and 34 years, a time of life when growth in height may most certainly be assumed to have been completed. They are classified as follows:

True Americans,	173.6 cm.
Southern States,	175.0 "
British America,	173.0 "
Englishmen,	170.1 "
Scottish,	171.3 "
Irishmen,	171.1 "
Germans,	169.6 "
French,	169.1 "
Scandinavians,	171.8 "
Spaniards,	168.4 "
Belgians,	168.6 "

Erismann believes that these different nationalities would not have reached this average height in their own native country, and that the different conditions of environment peculiar to this country caused this discrepancy. Topinard puts the average height of Frenchmen at 165.9 cm., and Beddoe places the average height of Englishmen in their own home at 169 cm., while the mean height of Italians, according to Topinard, ranges between 161 and 166 cm.

Roberts, speaking of the most favored classes of English people, in which class he includes naval and military men and university students, puts their average at 175.26 cm.

It was mentioned in the beginning of this paper that Naval Cadets, being appointed from every part of this country, ought to give us as nearly as possible an average that might be considered *national* in character. Now, the average height, as found in our tables of Naval Cadets, is 174.29 cm. at the age of 23, and the mean height is 174.04. If we take the average of what Gould calls true Americans and Americans from the Southern States we obtain 174.30, which is within 1-100 of a centimeter the average height of our Naval Cadets. This agreement of these averages ought to go far in establishing the average height of Americans as at 174.3 cm. when fully developed and of the class which these records cover.

Examining our table of averages a little more closely we find:

1. *Weight.* In weight there is an almost steady increase from the 15th to the 23d year, amounting in all to 37 pounds, the annual increase declining, of course, as age advances.

2. *Height.*—The greatest addition to height standing takes place between 15 and 16 years of age, after which age the annual increase rapidly declines and growth is distinctly retarded about the 18th year, whence again a more marked increase occurs, which comes to a close at the age of 21; a third upward curve leads to the attainment of the final growth.

3. *Height sitting* practically comes to a close at 19 years of age.

4. *Height perineal,* which is the height from the heel up to the perinaeum, closes at about the same age as the preceding.

5. *Circumference of chest* becomes highest at 19, to which it attains at rapidly advancing rates, and thence becomes steady or advancing only by small fractions of an inch.

6. *Lung capacity,* as ascertained by the spirometer, reaches its maximum at 19 and continues steady or varies only slightly.

7. *Waist* shows a continued increase up to the 23d year, remaining, however, stationary from 19 to 21, and after that continues to increase more rapidly.

8. *Span of arms.*—Its greatest increase takes place between 15 and 16 years of age; it then increases slowly but steadily until the 23d year.

9. *Vision.*—We notice here the significant fact that both right and left vision show a positive increase up to the 19th and 20th year. This fact seems of some importance in apparently demonstrating that the course of study at the naval school, and the strain that is necessarily put upon the organ of sight, does not in itself tend towards diminishing the degree of distance vision in an otherwise normally constituted eye, but that, on the contrary, it is rather advantageous in slightly but perceptibly increasing the visual range. The slight decrease in distant vision noticed at the 23d year would indicate to my mind and to those acquainted with life at sea and its requirements on those actively engaged in it, the result of undue strain.

10. *Hearing.*—As to hearing, it is perhaps equally significant that that organ is affected quite perceptibly, but in the contrary direction; we may notice here a gradual but steady decrease for both sides during the entire period under observation, and, no doubt, the occupation of Naval Cadets would lead us to expect just such a result.

11. *Squeeze* shows a steady increase, with but slight and unessential variations.

There exists some difference of opinion as regards the relation of the period of accelerated growth to puberty. If growth and procreation are, as they have been designated, antagonistic processes, we must agree with Bowditch, in that the period of accelerated growth is praepubertal in time. It would perhaps also follow quite naturally that the fullest establishment of maturity should be followed by a period of *retarded growth*, as is apparently shown in our figures of the annual growth. We do not find any great cause for controversy with regard to this question, nor do we consider it difficult to reconcile the opinions held by Bowditch on the one hand and by Pagliani and Carlier on the other. The beginning of the stage of puberty is not necessarily that of sexual maturity. Nature prepares the individual for sexual maturity and the process of procreation by inaugurating changes that are advantageous to the species and by causing increased development in various dimensions. This sudden wave of normal development completed, it results in sexual maturity becoming fully established and functional, and with its full establishment, growth in the different dimensions takes a short and much-needed rest, during which the organism at large sympathetically accommodates itself to the new order of things.

It is more than merely probable that the exact time of life when this praepubertal development begins is, within a certain limited range, different for every individual even of the same type and social class. In some it may come on a little sooner, in others a little later, so that these two phenomena must neutralize each other to a certain extent by this overlapping, and the probable result must be that the absolute praepubertal increase is actually larger than it is usually recorded.

Neither the average nor the mean gives us any information as regards the manner in which the individual measurements of a series are distributed, and it is clear that two series with an identical mean or average may yet differ largely in respect of the dispersion of the individuals from the middle value, as was shown above.

According to Boas, the mean deviation is the more accurate of the two, and which is no doubt true; but inasmuch as its relation to the probable deviation would be in all respects constant, and as it was one of our objects to make the results of our investigations comparable to those of previous investigators, the preference was given to the probable deviation.

Table VIII represents the probable deviations for the items that were available for calculation. It will be seen by this table that they are small, even when compared with those given in Porter's tables, which indicates that one-half of all the observations deviate but little from the middle values, and which fact is considered to be one of the fundamental attributes of all deviations due to accidental causes.

It is extremely doubtful from present appearances whether any further significance will ever be attached to the percentile grade system in the future than that of using it merely as a means for classifying anthropometric facts in percentages.

Boas, in his latest contribution to "Science," March, 1895, states that if the assumption is made that the same children remain on the average in the same percentile grades, a certain very complex law must follow; for any different law of growth, children would change from one grade to another. And Porter remarks that in order to determine the relation of the growth of the individual to the growth of the type we must have material that admits of the application of the individualizing method, and that the present state of our knowledge of the subject does not permit us the prediction of future growth.

I believe that the prediction of future growth, even after having accumulated a sufficient amount of material which will permit of the application of the individualizing method, will always form a difficult if not doubtful task, for the reason that we are unable to predict, at the same time, the causes that will influence individual growth.

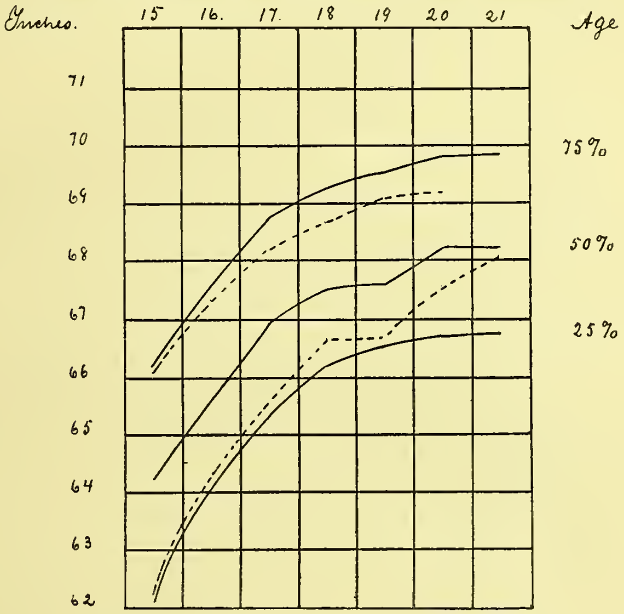
In the records at my disposal I find that their continuity is often broken by the omission of one or more items for one or more years in succession. This may be due to an oversight on the part of the examiner, or to a temporary inability on the part of the examinee to submit to that part of the examination. Hence if a very large number of such continuous individual records were required, even the material at my disposal would not be such as to definitely settle this question practically; and if I were to rely on broken records and put a larger number of these together and average them, I would simply arrive at about the same curves that are presented as the results of the whole number of observations. In fact, our averages and means and the deviations therefrom are the results of just such records, about 30 per cent of them being continuous and, with the exceptions mentioned, unbroken for the period of growth covered by them.

However, on searching these records I was able to find between 35 and 40 continuous records of individual cadets, each beginning with the 25th percentile grade in height as well as in weight, either at 15 or 16 years of age, and as many such as began with the 75th percentile grade in the same items and at the same ages. These, when examined individually and compared to the average progression of their respective percentile grades obtained from the whole number of observations that are recorded here, revealed the fact that not a single one of them remained in the grade to which it belonged.

The exact number of individual records belonging to the 25 percentile grade as to weight is 40, and that of those belonging to the 75th percentile grade is 36. As to height standing, there were 39 belonging to the 75th and 37 belonging to the 25th percentile grade.

FIG. 2.

Height.—Percentile and Individual Curves Compared.



Continuous lines: normal, 75, 50 and 25 per cent.
Broken lines: individual, 75 and 25 per cent.

The averages of these records have been tabulated together with the 25th, 50th and 75th percentile grades obtained from the whole number of observations, viz. Table XIII.

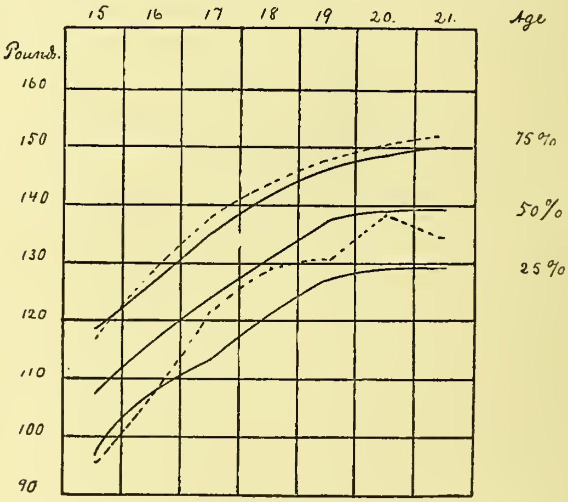
The relation which these individual averages bear to the general averages is best seen in Figs. 2 and 3 plotted from the tables.

The 25th percentile individual curve of both height and weight shows a marked tendency to approach the 50th percentile grade curve or the mean of all the observations. As to height alone, the 75th percentile individual curve likewise, but not so directly as the 25th percentile curve, inclines toward the curve of the middle value. In both the height-curves there is, it would seem, *a strong aim at the middle value towards the end of the period of growth.*

The curves, shown in Fig. 2, and a detailed comparison of the individual records with the normal percentile grades of their class, *would go far in convincing me of the fact that individuals do not necessarily remain in the percentile grades in which, at some time during their period of growth, they may happen to be found.*

FIG. 3.

Weight.—Percentile and Individual Curves Compared.



Continuous lines: normal, 75, 50 and 25 per cent.
Broken lines: individual, 75 and 25 per cent.

As, however, this question seems to be one of the greatest importance, and inasmuch as a definite settlement of all doubts in regard to this matter would be looked upon as a positive advance of our ideas of growth, we have attempted to enter a little more into the details of the matter.

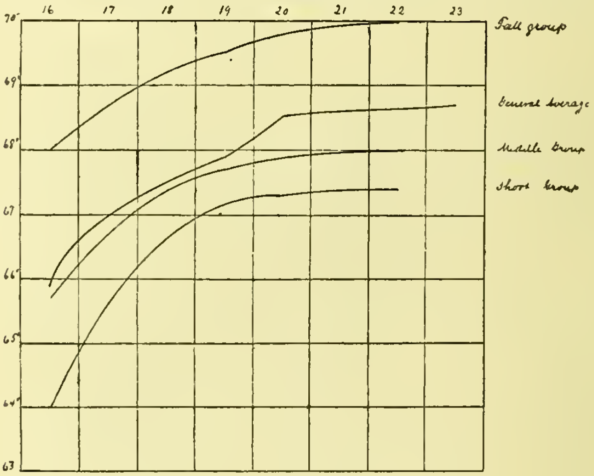
We began by making a somewhat larger collection of individual and continuous records. By allowing a broader limit than a certain percentile grade to begin with, we have succeeded in accumulating the data exhibited in the three Tables XIV, XV and XVI, and have divided them into three groups for reasons which will become more apparent as we proceed. It was perhaps to be expected that growth for tall boys would be found to be different from what it is for short ones, and these tables seem to prove this suspicion to be absolutely correct. When the averages given in these three tables are compared it becomes very evident that there is a well characterized law of growth for each of the three groups, that is to say, it is seen that the short boys grow more rapidly than the tall boys and also more rapidly than middle-sized boys during the period under consideration. Thus we find that the short boys grow 4.2 inches, the middle-sized ones 3.3 inches, and the tall ones only 2.0 inches during a period from 16 to 22 years of age. Previous conditions may perhaps often determine the growth that follows, and the smaller a boy at a certain age during the period of growth the greater will be his chances for growing during the years that follow, while tall boys are very much more apt to have their growth completed earlier than small boys are. Still it seems we cannot deny that present environments and causes also continue to exert an unmistakable influence on growth no matter what the preceding ones may have been.

In order to bring out the difference in the growth of the several groups still more clearly we have made certain selections from the larger tables between definite limits, and have calculated the averages and the probable deviations from different years. The selection was made at every year between the limits indicated on the tables, and then the number of individuals thus selected was carried straight through to the twenty-second year, as shown in Table XVII. It will be noticed by a glance at the table (XVII) that while the averages increase from beginning to end as well as from above downwards during the same years or in the direction from the lowest to highest average, the probable deviations increase only from year to year; but when read from above downwards they very rapidly decrease. In the tall group the averages increase but slightly from year to year in each group and from within the limits indicated; but when read from above downwards they tend to decrease in spite of the limits from which they were started growing steadily higher. The limit of this decrease, however, is soon reached and the averages increase correspondingly. The reason for this behavior in the averages is that the number of those that cease growing increases rapidly and consequently drop out of the succeeding series which contains naturally the tallest and the fewest.

The probable deviations always show a rapid increase between the first two years of every new series; they regularly decrease from above downwards and approach more nearly the average.

FIG. 4.

Annual Growth of Average of whole number of obs. compared with that of three selected individual groups.



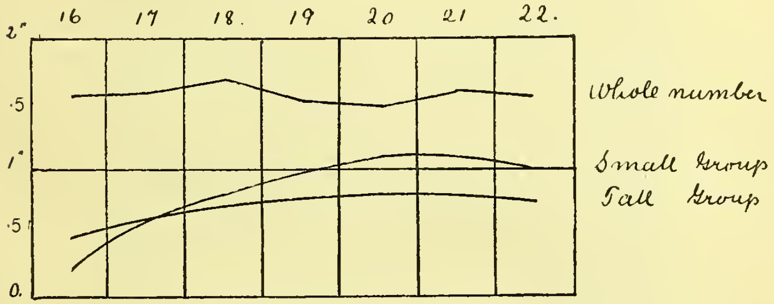
This increase in the probable deviation between the first two years or at the beginning of each series is, no doubt, due to the rapid scattering of the members in each series, and plainly shows that they do not retain the same relation to each other in the next series in which they were contained in the preceding series, and which is additional proof of the fact that *percentile grades do not control growth.*

The average values, showing the absolute annual increase, are not necessarily the most frequent values, as is well known, and consequently we must find out something of the individual growth and their numerical proportion and distribution which produce this average.

For this purpose we have calculated the individual growth between two successive years from our original Tables XIV, XV and XVI and tabulated the results represented in Table XVIII. This table of the individual absolute annual increases in height shows at once the distribution of growth, the most frequent values, and also, in a very striking manner, the number of those who cease to grow and at what age. The difference in the growth between tall and short boys is here brought out very strongly. The figures show as clearly as one could wish that tall boys are much more likely to have completed their growth at an earlier age than short boys, and also that short boys not only grow more rapidly and more extensively than tall boys, but also that they continue to grow up to a later age than do tall boys.

The rapidly increasing numbers at zero, to be seen on Table XVIII, prove conclusively that tall boys have completed their adult stage of development in height at an earlier age than short ones.

FIG. 5.



Probable Deviations compared.

In perfect agreement with this conclusion would seem to be the probable deviation as shown in Fig. 5. In small boys this deviation is seen to rise much higher than in tall ones.

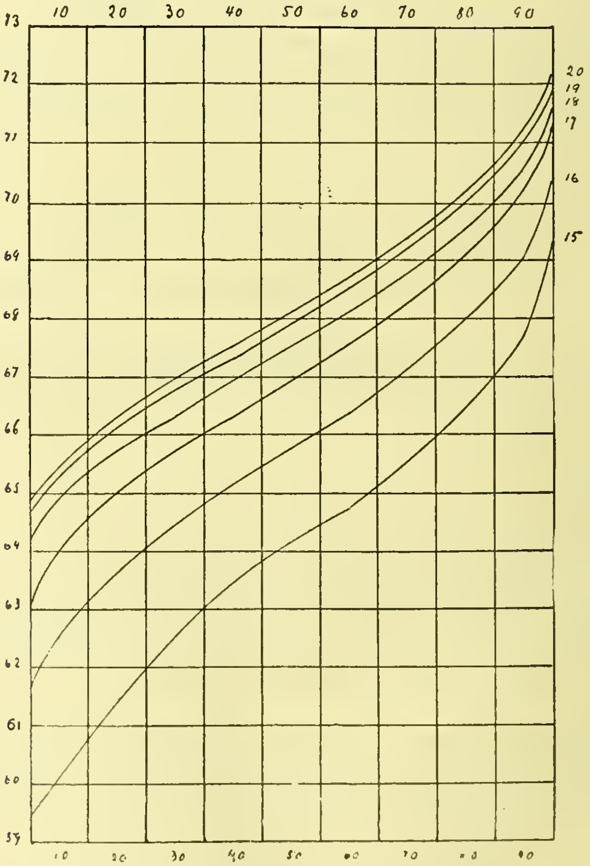
PERCENTILE GRADES IN HEIGHT STANDING, WEIGHT, HEIGHT SITTING, PERINEAL HEIGHT, CIRCUMFERENCE OF CHEST, LUNG. CAPACITY, SPAN OF ARMS, WAIST MEASURE, AND RIGHT AND LEFT HAND SQUEEZE.

The percentile grades in these various dimensions are presented in Tables XIX-XXVIII, and those of height standing and weight are also graphically represented in Figs. 6 and 7 respectively. With the help of these tables and plates the percentile rank of any individual in any of the above-mentioned dimensions may be easily and quickly determined.

Supposing, for instance, the percentile rank of a cadet aged 17 years and weighing 134 pounds was desired. A horizontal line is drawn from 134 in the column of weights on the left of the plate to the curve of age 17, and a perpendicular is dropped from the

FIG. 6.

Heights of Naval Cadets.—Percentile Grades.

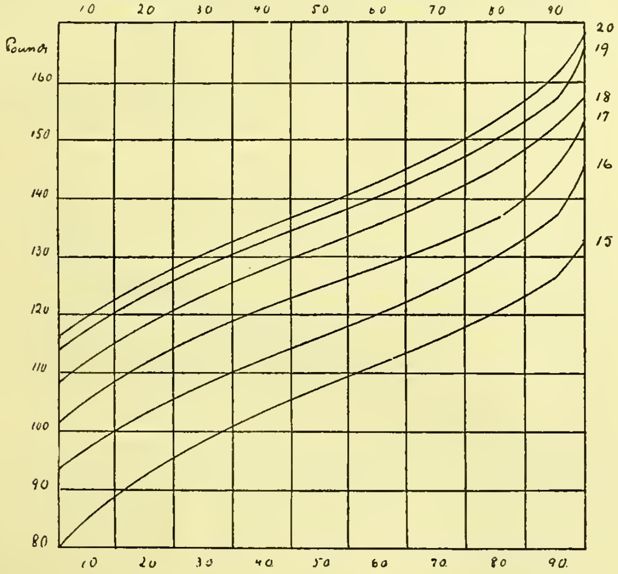


point of intersection to the scale of percentile grades at the bottom of the plate. The perpendicular falls at 75 per cent, and hence the cadet in question is heavier than 75 per cent of the cadets of his age and lighter than the remaining 25 per cent.

Likewise we may find the increase at any percentile grade during one or more years by measuring the distance between the curves at that grade and comparing that distance with the pound scale, which will give the number of pounds. In the same plate the gain in weight of the 50 percentile grade cadet during the years of 15 and 18 is 24 pounds, and the gain in weight of the 80th percentile grade cadet during the same period is found to be 25 pounds.

Fig. 7.

Weight of Naval Cadets.—Percentile Grades.



In a somewhat similar manner the percentile rank of any cadet at any age in any dimension included in our tables may be found by a reference to these tables. Their value, therefore, as an aid to the annual examiner of cadets may easily be estimated.

Rate of Growth.

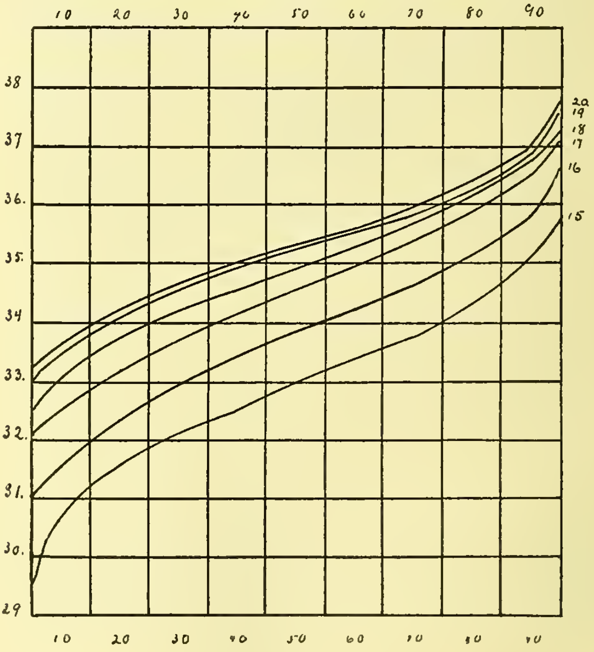
The ten tables XXIX-XXXVIII represent in percentile grades the absolute annual increase in the various dimensions as calculated from the whole number of observations and without regard to whether they are large or small. By absolute annual increase is meant the gain in height or weight during the preceding twelve months, obtained by subtracting the average or median height or weight at, for instance, 18 from that at 19 years.

On account of the unequal distribution of the numbers between the different years, the ages given in the column are not absolutely correct, but the error is so small that it may be neglected here.

It will be noticed that the rate of increase in the various dimensions differs considerably. The subject of the correlation of the different dimensions to one another at the different ages and in individuals of different statures is still to be determined. To settle this question we need a large number of individual records.

Fig. 8.

Perineal Height of Naval Cadets.—Percentile Grades.



As regards weight, we notice a steady decrease in the annual amount of gain from the 15th to the 21st year, which decrease becomes most marked from the 19th year on upwards, and in the highest percentile grades is even negative.

Height once attained is not so easily lost, but weight is easily lost as well as quickly regained.

As to height, the greatest annual increase is noticed to take place between 15 and 16 years of age, the lowest between 18 and 19 years. In some of the highest percentile grades it apparently becomes slightly negative as it does in the weight tables; this is more especially shown between the 21st and 22d years, but also noticeable between the 20th and 21st years. The reason for this negative annual increase is well explained by our Tables XIV, XV and XVI, which show clearly that just about the 21st year our averages are less reliable than they are at other ages, and therefore our annual growth tables do not in the least render improbable the fact that height once attained is rarely if ever lost.

Weight and strength, on the other hand, are easily lost and rapidly regained, and any decrease in these may therefore be easily explained.

Relative Annual Increase.

The ten tables XXXIX-XLVIII represent in percentile grades the relative annual growth in the different dimensions under discussion. Relative annual increase means the increase for any year divided by the average at that year. Thus the relative annual increase in weight at age 18 is the difference between the average weight at 17 and 18 divided by the average weight at 17.

According to Porter (loc. cit.) the relative annual increase gives a truer idea of growth than does the absolute annual increase, because of the latter being entangled with the size of the individual measured. Porter also states that "the absolute annual increase is commonly greater in a big boy than in a small boy,and yet the rate of growth may be the same." This is no doubt true for that period of growth which is covered by the material worked out by him. For a later period, from 15 to 22 years, the rate of growth for big boys is both absolutely and relatively smaller than for short boys. This is not only well shown in our percentile height-curves on Fig. 6, plotted from the whole number of our observations, but also in our individual Tables XIV, XV and XVI, as well as in Fig. 4.

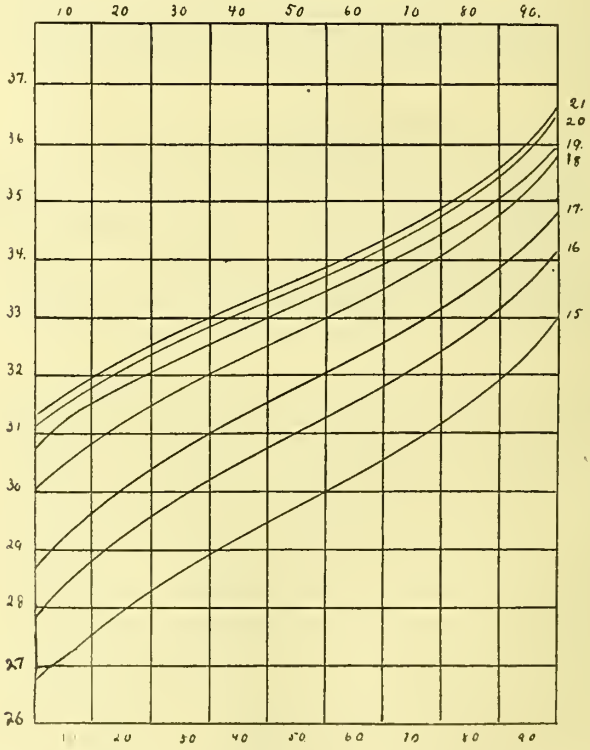
So far as weight is concerned these tables show the same gradual decrease in the annual rate as the height tables. This decrease is here most abruptly marked between 19 and 20, becoming negative with the 21st year.

Tables XLIX-LVIII.

The material here presented would admit of still further elaboration. The dimensions of correlated parts and their ratios to one another ought to be worked out. The difficulty, however, that presents itself here is the same that was encountered in connection with the rate of growth and its difference between tall and short boys. The facts so far would indicate that, for instance, the ratio that exists between growth in height and chest girth is different for short boys from what it is for tall boys. This work must be done on material admitting of the application of the individualizing method and separately for small, middle-sized and tall individuals, to be of value and conclusive.

Fig. 9.

Chest Girth of Naval Cadets.—Percentile Grades.



The tables XLIX-LVIII, however, will prove useful, admitting, as they do, of ready reference and comparison and containing a great deal of information in a small space.

APPENDIX.

TABLE I.

The observed distribution of the Heights of the 842 Naval Cadets aged 18 yrs.

Heights at intervals of one inch.	Number of Observations.
75–76	1
74–75	2
73–74	5
72–73	23
71–72	38
70–71	80
69–70	118
68–69	135
67–68	146
66–67	135
65–66	94
64–65	38
63–64	15
62–63	8
61–62	3
60–61	
59–60	1
Total..	842

TABLE II.

The calculation of the Average Hand-Squeeze (right) of 225 Naval Cadets aged 17 years.

Strength in Pounds.	Number of Observations. (n)	Product (a)
50	2	100
55	3	165
60	15	900
65	18	1170
70	30	2100
75	43	3225
80	40	3200
85	34	2810
90	20	1800
95	11	1045
100	6	600
105	3	315
Total..	$n = 225$	$\Sigma a = 17430$

$$A = \frac{\Sigma a}{n} = \frac{17430}{225} = 75.46 \text{ pounds.}$$

TABLE III.

The calculation of the Probable Deviation (d) from the average weight (125 lbs.) of 722 Naval Cadets aged 17 years.

Weight at intervals of five pounds.	n No. observed.	δ Deviation.	$n\delta$
195–200	1	75	75
170–175	2	50	100
165–170	2	45	90
160–165	6	40	240
155–160	11	35	385
150–155	19	30	570
145–150	24	25	600
140–145	51	20	1020
135–140	59	15	885
130–135	85	10	850
125–130	97	5	485
120–125	97	0	
115–120	82	5	410
110–115	71	10	710
105–110	61	15	915
100–105	35	20	700
95–100	7	25	175
90–95	9	30	270
85–90	2	35	70
80–85	1	40	40
	722		8490

$$d = \pm 0.8453 \frac{8490}{722} = \pm 9.94.$$

TABLE IV.

The theoretical and observed distribution of the Heights of 722 Naval Cadets aged 17 years.

Probable Deviation.	Height at intervals of $\pm 0.5d$.	Theoretical Distribution.	Observed Distribution.
+ 5.0 d	75.00	1	1
+ 4.5 "	74.20	2	2
+ 4.0 "	73.40	4	5
+ 3.5 "	72.60	9	11
+ 3.0 "	71.80	17	18
+ 2.5 "	71.03	30	32
+ 2.0 "	70.20	48	46
+ 1.5 "	69.40	69	70
+ 1.0 "	68.60	87	90
+ 0.5 "	67.80	94	91
0.0 "	67.00		
— 0.5 "	66.20	94	99
— 1.0 "	65.40	87	94
— 1.5 "	64.60	69	72
— 2.0 "	63.80	48	48
— 2.5 "	62.97	30	14
— 3.0 "	62.20	17	16
— 3.5 "	61.40	9	5
— 4.0 "	60.60	4	5
— 4.5 "	59.80	2	2
— 5.0 "	59.00	1	1
		Total..722	722

TABLE V.

Stieda's Table for calculating the number of observations at any distance from the mean or average within the limits: $M + 5d$ and $M - 5d$.

p.	%	p.	%
0.1	5.4	1.8	77.5
0.2	10.7	1.9	80.0
0.3	16.0	2.0	82.3
0.4	21.3	2.1	84.3
0.5	26.4	2.2	86.2
0.6	31.4	2.3	87.9
0.7	36.3	2.4	89.5
0.8	41.1	2.5	90.8
0.9	45.6	2.6	92.1
1.0	50.0	2.7	93.1
1.1	54.2	2.8	94.1
1.2	58.2	2.9	95.0
1.3	61.9	3.0	95.7
1.4	65.5	3.5	98.2
1.5	68.8	4.0	99.3
1.6	71.9	4.5	99.8
1.7	74.8	5.0	99.93

TABLE VI.

The percentile distribution of the Heights of 841 Naval Cadets aged 18 years, according to this method.

Percentile Grades.	Heights.
5	64.56
10	65.00
20	65.90
30	66.70
40	67.01
50	67.66
60	68.54
70	69.00
80	69.58
90	70.55
95	71.52

Table VII.

Probable Error of Average: $E = \pm \frac{d}{\sqrt{n}}$, where e = probable error. d = probable deviation. n = number of observations.

Dimensions.	Unit of Measurement.	Age at nearest Birthday and Probable Error. 15	16	17	18	19	20	21	22	23
Weight, (nude).........	pounds.	0.922	0.531	0.370	0.400	0.360	0.371	0.456	0.500	0 768
Height, standing.......	inches.	0.136	0.080	0.059	0.057	0.054	0.060	0.071	0.086	0.099
Height, sitting.........	inches.	0.088	0.048	0.032	0.027	0.035	0.027	0.024	0.040	0.036
Height, perineal........	inches.	0.131	0.064	0.045	0.040	0.031	0.038	0.070	0.062	0.073
Chest circumference....	inches.	0.123	0.066	0.044	0.043	0.038	0.048	0.052	0.065	0.079
Lung capacity..........	cb. inches.	2.306	1.091	0.820	0.712	0.642	0.834	0.940	1.150	1.125
Waist circumference....	inches.	0.095	0.052	0.042	0.044	0.044	0.052	0.062	0.070	0.093
Span of Arms...........	inches.	0.130	0.091	0.064	0.060	0.062	0.072	0.076	0.108	0.093
Vision, R. E............	feet.	0.270		0.103	0.108	0.120	0.163	0.163	0.163	0.243
Vision, L. E............	feet.	0.231	0.132	0.111	0.108	0.115	0.133	0.127	0.172	0.233
Hearing, R. Ear........	feet.		0.069	0.050	0.058	0.054	0.100	0.076	0.247	0.238
Hearing, L. Ear........	feet.			0.036	0.036	0.027	0.073	0.110	0.210	0.234
Squeeze, R. H..........	pounds.	0.800	0.367	0.273	0.245	0.274	0.316	0.365	0.449	0.421
Squeeze, L. H..........	pounds.	0.790	0.367	0.274	0.250	0.273	0.322	0.327	0.463	0.466

Table VIII.

Probable Deviation (d) from the average: $d = \pm 0.8453 \frac{\Sigma \delta}{n}$, where δ = Deviation of average. $\Sigma \delta$ = Sum of individual deviations. n = Total number of observations.

Dimensions.	Unit of Measure.	Age at nearest Birthday and Probable Deviation. 15	16	17	18	19	20	21	22	23
Weight................	kilos.	4.808	4.790	4.508	5.116	4.472	4.277	4.599	4.114	5.357
	pounds.	10.6	10 56	9.94	11.28	9.86	9.43	10.14	9.07	11.81
Height, standing.......	c. m.	4.97	3.96	4.03	4.20	3.81	3.81	4.01	3.96	3.83
	inches.	1.96	1.56	1.59	1.68	1.50	1.50	1.58	1.56	1.51
Height, sitting........	c. m.	2.56	2.43	2.18	2.05	2.49	1.77	1.37	1.88	1.44
	inches.	1.01	0.96	0.86	0.81	0.98	0.70	0.54	0.74	0.57
Height, perineal......	c. m.	3.83	3.27	3.17	3.09	2.18	2.49	4.24	2.89	2.84
	inches.	1.51	1.29	1.25	1.22	0.86	0.98	1.67	1.14	1.12
Circumference Chest....	c. m.	3.60	3.37	3.12	3.20	2.64	3.03	2.94	2.99	3.04
	inches.	1.42	1.33	1.23	1.26	1.04	1.22	1.16	1.18	1.20
Lung capacity..........	cb. c. m.	427.	355.	360.	373.	320.	376.	330.	330.	312.
	cb. inches.	26.1	21.69	22.0	22.87	19.6	21.19	20.84	20.83	19.05
Circumference Waist....	c. m.	2.76	2.61	2.87	3.30	3.07	3.37	3.50	3.25	3.60
	inches.	1.09	1.03	1.13	1.30	1.21	1.33	1.38	1.28	1.42
Span of Arms..........	c. m.	2.99	4.59	4.41	4.44	4.36	4.69	4.26	5.02	3.60
	inches.	1.18	1.81	1.74	1.75	1.72	1.85	1.68	1.98	1.42
Vision, R. E............	meter.	.917	.183	.847	.956	1.002	1.261	1.106	.927	1.130
	feet.	3.09	0.6	2.78	3.14	3.29	4.14	3.63	2.95	3.71
Vision, L. E...........	meter.	.811	.799	.914	.950	.980	1.029	.857	.947	1.081
	feet.	2.66	2.62	3.0	3.12	3.21	3.38	2.81	3.12	3.55
Hearing, R. Ear........	meter.		.420	.411	.515	.463	.771	.515	1.365	1.106
	feet.	0.0	1.38	1.35	1.69	1.52	2.53	1.69	4.48	3.63
Hearing, L. Ear........	meter.			.298	.317	.231	.564	.741	1.161	1.181
	feet.	0 0	0.0	0.98	1.04	0.76	1.85	2.43	3.81	3.88
Squeeze, R. H..........	kilos.	4.136	3.311	3.325	3.225	3.411	3.643	3.679	3.681	2.912
	pounds.	9.12	7.30	7.33	7.11	7.52	8.03	8.11	8.14	6.42
Squeeze, L. H..........	kilos.	4.136	3.316	3.370	3.273	3.370	3.715	3.293	3.810	3.220
	pounds.	9.06	7.31	7.43	7.22	7.43	8.19	7.26	8.40	7.10

Table IX.

Values of the Averages in the following dimensions.

Age at nearest Birthday.	No. of Observations.	Weight in kilos., pounds.	Height, standing, c.m., inches.	Height, sitting, c.m., inches.	Height, perineal, c.m., inches.	Circumference of Chest, c.m., inches.	Lung capacity, litres, cb. inch.	Waist, c.m., inches.	Span of Arms, c.m., inches.	Vision, R. E., metres, feet.	Vision, L. E., metres, feet.	Hearing, R. Ear, metres, feet.	Hearing, L. Ear, metres, feet.	Squeeze. R. H. kilos, lbs.	Squeeze. L. H. kilos, lbs.
		48.53	162.052	84.58	81.28	77.47	2.998	63.75	162.30	7.314	7.314	12.192	12.192	27.66	27.21
15	132	107.	63.8	33.3	32.0	30.5	183	25.09	63.9	24.0	24.0	40.0	40.0	61.0	60.
		53.01	167.456	86.48	83.82	80.51	3.293	66.04	170.94	7.332	7.559	11.978	12.192	32.43	31.75
16	395	118.	65.93	34.5	33.2	31.67	201	26.0	67.33	24.6	24.8	39.3	40.0	71.5	70.
		56.70	170.30	88.90	86.36	82.55	3.555	69.59	172.72	7.742	7.620	11.887	12.009	35.127	34.74
17	722	125.	67.05	35.0	34.0	32.5	217	27.36	68.0	25.4	25.0	39.0	39.4	77.47	76.6
		60.55	170.710	90.79	87.36	85.09	3.702	70.80	175.84	7.711	7.528	11.826	11 978	36.74	36.28
18	841	133.4	67.29	35.75	34.6	33.46	226	27.9	69.25	25.3	24.7	38.8	39.3	81.0	80.
		63.36	172.466	91.56	91.8	88.90	3.932	72.61	178.05	7.711	7.681	11.887	12.039	38.55	37.64
19	750	139.7	67.90	36.50	35.9	35.0	240	28.6	70.12	25.3	25.24	39.0	39.5	85.0	83.
		64.05	174.117	89.10	88.90	87.12	3.915	72.64	178.05	7.345	7.925	11.643	11.826	39.46	38.55
20	645	141.2	68.55	35.77	35.0	34.3	239	28.62	70.1	24.1	26.0	38.2	38.8	87.0	85.
		63.40	174.224	91.44	86.36	87.12	3.948	72.89	179.83	7.437	7.620	11.887	11.582	39.91	39.64
21	493	140.	68.6	36.0	34.0	34.3	241	28.68	70.67	24.38	25.0	39.0	38.0	88.0	87.4
		64.09	173.863	91.44	88.90	87.20	4.030	73.15	178.30	7.498	7.406	11.217	11.338	39.23	38.91
22	328	141.3	68.45	36.0	35.0	34.35	246	28.8	70.2	24.6	24.34	36.8	37.2	86.5	85.8
		65.31	174.294	91.44	88.90	88.39	3.964	74.16	180.34	6.888	7.010	11.427	11.368	39.28	38.42
23	232	144.0	68.62	36.0	35.0	34.8	242	29.2	71.0	22.6	23.0	37.5	37.3	86.6	84.7

TABLE X.
Median Values in same dimensions as Table IX.

Age at nearest Birthday.	No. of Observations.	Weight.	Height, standing.	Height, sitting.	Height, perineal.	Circumference of Chest.	Lung capacity.	Waist Circumference.	Span of Arms.	Squeeze, R. H.	Squeeze, L. H.
15	131	49.216 108.5	163.29 64.290		84.12 33.125	76.07 29.952	2.920 178.2	63.70 25.12	163.83 64.50	27.21 60.0	25.58 56.4
16	395	53.025 116.9	167.13 65.805	85.34 33.500	85.92 33.830	78.99 31.101	3.170 193.5	65.45 25.77	169.67 66.80	30.84 68.0	29.48 65.
17	722	56.610 124.8	170.18 67.000	86.81 34.180	87.88 34.600	81.25 31.895	3.421 208.8	67.18 26.45	172.46 67.90	34.10 75.2	33.33 73.5
18	841	59.780 131.8	171.78 67.633	87.96 34.630	88.90 35.007	83.00 32.685	3.588 219.0	69.13 27.22	174.11 68.55	35.14 77.5	34.01 75.0
19	750	62.14 137.0	171.83 67.651	89.07 35.055	89.50 35.243	84.45 33.250	3.736 228.3	70.10 27.60	175.33 69.03	37.19 82.0	36.96 81.5
20	645	62.823 138.5	173.35 68.252	89.53 35.254	89.68 36 310	85.29 33.588	3.818 233.2	71.06 27.98	176.27 69.40	38.00 83.8	37.19 82.0
21	493	63.004 138.9	173.25 68.215	90.01 35.445	89.76 35.340	85.47 33.656	3.801 232.2	70.33 27.69	177.62 69.93	38.91 85.8	38.32 84.5
22	328	62.914 138.7	173.60 68.352	89.71 35.320	90.14 35.492	85.77 33.776	3.883 237.9	70.63 27.81	176.78 69.60	38.55 85.0	38.00 83.8
23	232	62 732 138.3	174.04 68.522	89.73 35.333	90.55 35.654	86.28 33.873	3.872 236.3	70.84 27.89	174.62 69.93	40.37 89.0	38.55 85.0

TABLE XI.
Median minus Average Values.

Dimensions.	Unit of Measurement.	Ages at nearest Birthday and Median minus Average Values.								
		15	16	17	18	19	20	21	22	23
Weight	pounds.	+ 1.5	− 1.1	− 0.2	− 1.5	− 2.7	− 2.7	− 1.1	− 2.6	− 5.7
Height, standing	inches.	+ 0.490	− 0.125	− 0.05	+ 0.343	− 0.249	− 0.298	− 0.385	− 0.098	− 0.098
Height, sitting	inches.		− 1.000	− 0.820	− 1.120	− 1.445	− 0.516	− 0.555	− 0.680	− 0.667
Height, perineal	inches.	+ 1.125	+ 0.630	+ 0.600	+ 0.407	− 0.657	+ 0.310	+ 1.340	+ 0.492	+ 0.645
Chest circumference	cb. inches.	− 0.548	− 0.569	− 0.605	− 0.775	− 1.756	− 0.712	− 0.644	− 0.574	− 0.927
Lung capacity	cb. inches.	− 4.8	− 7.5	− 8.2	− 7.0	− 11.7	− 5.8	− 8.8	− 8.1	− 5.7
Waist circumference	inches.	+ 0.03	− 0.23	− 0.97	− 0.68	− 1.00	− 0.64	− 0.99	− 0.99	− 1.31
Span of Arms	inches.	+ 0.60	− 0.53	− 0.10	− 0.70	− 1.09	− 0.70	− 0.74	− 0.60	− 1.07
Squeeze, R. H	pounds.	− 1.0	− 3.5	− 2.27	− 3.5	− 3.0	− 3.2	− 2.2	− 1.5	+ 2.4
Squeeze, L. H	pounds.	− 3.6	− 5.0	− 3.1	− 5.0	− 1.5	− 3.0	− 2.9	− 2.0	+ 0.3

TABLE XII.
Showing Annual Growth of different Nationalities.

Ages.	Beyer, c. m.	Bowditch, c. m.	Kotelmann, c. m.	Roberts, c. m.	Erismann, c. m.	Porter, c. m. Av.	Porter, c. m. Mean.
13–14		6.80	5.79	5.4	3.48	5.67	5.57
14–15	2.54	6.10	5.31	5.1	5.45	6.32	6.39
15–16	5.41	6.90	7.46	5.6	6.53	5.37	6.02
16–17	2.84	2.10	5.25	6.7	5.38	4.86	4.73
17–18	0.60	1.60	1.49	3.9	3.19	5.28	4.50
18–19	1.54	1.40		1.9	1.80		
19–20	1.90			1.8	0.80		
20–21	.12						
21–22	.38						
22–23	.43						

TABLE XIII.
Comparison of Normal * with Individual Records.
I.—Height.

Percentile Grades.	Ages at nearest Birthday.						
	15	16	17	18	19	20	21†
Normal .75	66.20	67.61	68.70	69.29	69.51	69.86	69.83
Individual .75	66.10	67.45	68.25	68.76	69.10	69.15	69.80
Normal .50	64.29	65.85	67.00	67.63	67.65	68.25	68.21
Individual .25	62.20	64.44	65.62	66.70	66.65	67.62	68.07
Normal .25	62.05	64.14	65.50	66.18	66.54	66.75	68.74

II.—Weight.

Individual .75	117.0	129.3	138.0	144.0	148.0	150.0	152.0
Normal .75	118.5	127.8	135.0	143.0	147.5	149.6	149.9
Normal .50	108.5	116.9	124.8	131.8	137.0	138.5	138.9
Individual .25	95.5	107.5	122.0	130.0	130.3	137.0	134.4
Normal .25	95.9	106.2	114.4	121.9	127.1	128.	129.3

* Number smaller than under the preceding years, especially in individual 75 percentile grade, and therefore this grade is not plotted.

† Refers to the averages derived from the whole number of observations, expressed here in percentile grades.

TABLE XIV.
Individual and Continuous Measurements in Height, Standing. Tallest Group.

No.	16	17	18	19	20	21	22	No.	16	17	18	19	20	21	22
	Inches at the following years.														
1	68.4	70.0	70.5	71.0	71.1		71.0	34	68.3	69.5	70.7	71.1	71.2		71.2
2	68.0	69.3	69.5	69.5	69.5		69.6	35	69.2	69.3	69.7	70.2	70.4		70.4
3	67.4	68.0	68.6	68.3	68.3		68.3	36	68.0	68.5	69.0	69.0	69.0		69.1
4	69.0	69.7	70.4	70.4	70.5		70.5	37	67.0			72.4	73.4	73.4	73.2
5	68.0	68.5	68.7	69.3	69.4			38	68.5	69.2	69.2	69.4	69.7	70.0	70.1
6	67.4	68.0	68.2	68.3	68.3		68.5	39	68.0	69.5	71.0	72.0	72.1		
7	68.2	68.6	68.7	69.0	69.1		69.1	40	67.4	68.1	68.4	68.4	68.6		68.6
8	68.5	69 2	69.3	69.5		69.7		41	68.6	70.3	70.5	71.4	72.2		72.4
9	68.5	69.2	69.4	69.2	69.2		69.5	42	68.5	69.4	69.4	69.4	69.6		70.0
10	67.2	67.6	68.0	68.0	68.1		68.0	43	68.2	69.2	69.5	70.0	70.2		70.4
11	67.2	67.2	67.5	68.0				44	68.0	69 4	69.7	70.2	70.4		70.2
12	68.0	68.6	69.0	69.1	69.2		69.3	45	67.6	69.2	70.3	70.6	70.4		70.7
13		68.0	68.4	68.6	68.7	68.7	68.7	46	67.0	67.2	68.0	68.0	68.1		68.0
14		66.7	67.1	67.4	67.4	67.4	67.4	47	69.0	70.3	70.4	70.4	70.4		70.6
15	67.2	68.3	69.3	69.5	69.6	70.1	70.2	48	68.4	69.1	69.6	69.7	69.6		69.6
16	68.2	68.6	69.0	69.2	69.4		69.4	49	67.5	68.2	68.2	68.6	68.7		69.0
17	69.0	70.2	71.0	71.3	71.5		71.4	50	68.3	69 2	70.0	70.0	70.5		71.0
18	68.7	69.3	69.7	69.7	69.7		69.7	51	68.0	69.0	70.0	70.0	70.3		70.2
19	67.2	68.1	68.1	68.3	68.2		68.4	52	67.5	67.6	68.2	68.2	68.5		
20		67.0	67.2	67.5	67.7		67.6	53	67.1	67.6	67.6	67.6	67.7		68.4
21	68.6	69.4	69.4	70.0	70.1		70.1	54	67.4	68.2	68.7	69.4	69.4		69.6
22	69.0	69.2	69.2	69.2	69.2		69.2	55	67.6	68.3	69.2	69.3	69.6		69.6
23	67.0	68.1	68.5	68.7	69.0		69.1	56	67.0	67.4	67.7	68.1			68.1
24		66.3	69.4	70.1	70.4	70.4	70.5	57	67.2	67.6	67.7	68.1	68.4		68.4
25	68.2	69.4	71.0	71.4			71.4	58	68.2	69.2	69.6	70.0	70.2		70.2
26	67.7	68.1	68.2	68.3		68.4		59	67.2	68.2	69.1	69.7	69.7		70.2
27	69.4	70.4	71.2	71.2	71.5		71.6	60	68.0	68.5	69.3	69.3	69.6		70.0
28	67.4	68.4	68.4	69.0	69.4		70.0	61	67.2	68.3	69.0	69.3	69.3		69.4
29	68.2	69.4	70.2	71.2	71.2		71.2	62	69.0	69.6	70.3	70 3	70.6		70.6
30	69.0	69.0	69.0	69.0	69.5		69.4	63	68.0			71.2	71.2	71.2	71.7
31	67.0	68.3	68.7	69.0	69.1		69.1								
32	67.0	68.0	68.6	68.6	69.0		69.2	Av's..	68.0	68.7	69.2	69.5	69.8		70.0
33	67.2	67.4	68.0	68.6	68.6		68.6	$\pm d=$	0.49	0.62	0.68	0.76	0.79		0.75

Fractions in columns are eighths; the averages and deviation represented in inches and tenths.

TABLE XV.
Individual and Continuous Measurements in Height, Standing. Middle-sized Group.

No.	16	17	18	19	20	21	22	No.	16	17	18	19	20	21	22
	Inches at the following years.														
1	65.4	66.1	66.7	67.1	67.3			38	65.0	65.2	65.4	65.4	65.4		65.4
2	66.0	67.0	67.3	67.6	67.5	67.5		39	65.3	65.7	66.2	66.2	66.2		66.4
3	66.0	68.4	70.7	72.0	72.5		72.5	40	65.4	67.1	67.4	68.0	68.0		68.0
4		66.4	66.6	66.6	66.6	66.6	67.0	41	65.1	67.0	67.4	67.4			
5	66.0	67.0	67.4	67.4	68.		68.1	42	66.7	67.2	67.2	67.2	67.5		
6		67.0	67.2	67.2	67.5	67.6	67.6	43	65.5	66.5	67.2	67.2		67.3	
7		65.1	65.4	65.7	65.7	65.5		44	65.4	67.0	67.6	68.0	68.4		68.4
8	65.6	68.1	69.0	69.7	69.7			45	65.4	67.0	67.4	68.1	68.5		68.5
9		66.2	67.1	68.2	68.6	68.7	68.6	46	65.2	66.2	67.2	67.2	67.5		
10		66.2	67.1	68.2	68.6	68.7	68.6	47	65.1	66.0	66.2	66.3	66.4		66.5
11	65.3	66.2	66.5	66.6	67.0	67.0		48	65.4	67.0	69.0	69.5	69.7		69.6
12	65.5	66.3	66.5	66.5	66.6		66.6	49	66.0	67.3	68.7	69.6	69.7		69.6
13	66.2	67.5	68.2	68.5	68.2		68.5	50	65.4	68.4	69.0	69.3	69.4	69.4	69.4
14		65.2	65.5	65.6	65.7	65.7	65.7	51	66.2	66.4	67.3	67.3		67.4	
15	65.0	66.0	66.2	66.3	66.3		66.3	52	66.2	66.4	67.4	67.4	67.4		
16	66.0	67.0	67.2	67.6	67.7		67 7	53	66.6	68.2	68.4	69.0	69.0		69.0
17	66.5	67.4	68.2	68.2	68.6			54	66.5	67.1	67.1	67.1	67.1		67.4
18	65.1	65.7	66.4	66.4	66.4		66.4	55	65.3	66.4	67.0	67.3	67.4	67.4	67.5
19	65.0	65.6	66.6	66.6	66.6		66.6	56	65.6	67.0	67.4	68.0	68.2	68.1	68.
20	66.0	66.4	66.6	66.6	66.6		66.6	57	65.2	65.6	66.0	66.5	66.7	67.0	67.0
21	66.4	67.0	67.5	68.0	68.0		68.0	58	66.4	67 4	67.7	68.1	68.4		68.5
22	66.4	67.0	67.3	67.5	67.4		67.4	59	65.3	66.4	67.2	68.0	68.2		68.5
23	66.2	68.0	68.6	69.0	69.0		69.0	60	66.1	67.3	67.7	67 4	67.2		67.3
24	66.1	67.3	68.1	69.0	69.0		69.0	61	66.6	67.2	68.5	68.5	68.7		69.
25	66.1	66.5	67.0	67.0	67.0		67.2	62	66.4	68.2	69.0	69.6	70.2		70.4
26	65.1	65.4	65.4	65.4	65.5		67.5	63	65.2	66.0	67.0	67.0	67.2		67.3
27	66.3	67.3	67.5	67.4		67.5		64	65.2	67.0	68.0	68.3	68.3		68.4
28	65.2	65.5	66.5	67.0	67.6			65	65.6	66.4	66.6	66.7		66.7	
29		65.0	66.4	67.2	67.3	67.5	67.5	66	65.4		67.0	67.0	67.2		67.2
30	66.1	67.5	68.6	68.7	68.7		69.0	67	65.6	65.6	65.6	66.2	66.0		66.2
31	65.2	65.5	66.5	67.0	67.6			68	65.0	67.0	67.5	68.0	68.0	68.0	68.2
32	65.0	66 4	67.2	67.3	67.5		67.5	69	66.4	67.2	68.3	68.7	69.2	69.4	69.4
33	66.7	67.5	68.6	68.7	68.7		69.0	70	65.5	66.2	67.1	67.0		67.2	
34		66.0	68.0	68.4	68.6	69.	69.4	71	65.3	66.7	67.6	68.2	68.3	68.6	68.6
35		66.6	68.0	68.4	68.4		70.0								
36	65.2	66.0	67.0	67.0	67.3		67.3	Av's..	65.7	66.7	67.4	67.7	67.9		68.0
37	66.1	67.7	69.2	70.0	70.2			$\pm d=$	0.32	0.54	0.55	0.77	0.86		0.90

Table XVI.

Individual Continuous Measurements in Height, Standing. Short Group.

	Inches at the following years.														
No.	16	17	18	19	20	21	22	No.	16	17	18	19	20	21	22
1	62.½	65.0	67.6	69.5	70.2		70.6	28	60.4		64.2	65.2	66.7	67.0	67.0
2	63.7	65.2	67.0	67.7	68.2		68.2	29	62.6	63.5	64.4	65.0			
3	64.4	65.3	65.7	66.1	66.2		66.2	30	63.2	64.4	65.7	66.2	66.5		66.5
4	64.4	67.2	67.6	68.2	68.3		68.4	31	62.4	64.5	66.6	67.2	67.4		67.5
5	63.7	65.2	66.2	66.5	66.6		66.7	32	64.2		66.5	67.4	67.7		68.0
6	64.2	67.1	68.6	69.5	69.5		70.1	33	62.2		65.2	65.2	65.6		66.0
7	63.0	64.0	64.4	65.0	65.2		65.4	34	63.0	65.2	66.0	66.3	66.6		
8	64.0	66.2	68.5	70.0	70.4			35	62.1	64.6	65.6	66.1	66.4		67.0
9	64.0	65.0	65.4	66.0	66.2		67.4	36	64.0	64.5	65.3	65.4	66.0		66.0
10	64.6	65.7	66.6	67.3	67.4		67.5	37	62.7	65.2	66.4	66.6		67.0	
11	63.2	65.0	66.7	67.5	68.0		68.1	38	61.0	62.1	65.0	67.3	68.5		69.1
12	64.0	65.6	67.5	68.2	68.5		68.4	39	65.1	67.7	69.1	69.5		69.7	
13	64.1	65.6	67.5	68.2	68.5		68.4	40	63.0	64.2	65.2	65.3	65.6		66.
14	63.7	64.3	64.3	64.7	64.7		64.6	41	64.2	65.0	66.0	66.4	66.3		66.6
15	64.4	66.4	67.6	68.1	68.4		68.4	42	62.5	65.4	68.4	69.7	69.7		70.5
16	64.4	65.1	65.3	65.6	66.1		66.4	43	64.0	66.1	67.2	68.0			
17	64.3	65.6	66.6	67.1	67.1		67.2	44	62.0	63.3	64.5	65.2	65.2		65.3
18	61.0	62.7	64.4	65.2	66.1		66.3	45	63.5	65.2	66.6	67.4	67.6	67.6	67.6
19	61.3	63.5	65.0	65.5	65.6		65.7	46	64.5	64.5	64.7	64.7	65.1		65.2
20	63.6	64.5	65.0	65.0	65.3		65.7	47	61.0	63.0	65.0	65.6	66.0		66.0
21	63.2	65.6	65.7	65.7		66.0		48	62.2	65.2	67.0	67.4	67.7		68.0
22	63.2	65.4	66.2	66.2		66.6		49	64.1	65.2	66.1	67.2	67.3		67.5
23	64.3	65.6	66.6	67.1	67.3			50	63.0	64.4	68.0	69.0	69.3		69.4
24	61.2	63.0	66.6	68.0	69.0	69.6	70.4	51	63.1	66.2	67.0	68.0	68.3	68.2	68.6
25	64.0	65.5	67.0	67.1		67.1		52	62.4	65.3	66.6	68.5	69.2		69.6
26	63.2	64.2	64.7	64.5	64.6	64.7	65.1	Av's.	.63.3	65.0	66.3	67.0	67.3		67.5
27	63.4		67.7	68.1	68.1		68.6	$\pm d=$	0.13	0.61	0.90	1.06	1.07		1.07

Table XVII.

Averages and Probable Deviations calculated from certain limited measurements and from different years.

a. Small Group.

Inches.	16 years.	17 years.	18 years.	19 years.	20 years.	22 years.
63.5 — 64.7″ at	64.0 $\pm$ 0.2	65.6 $\pm$ 0.6	66.7 $\pm$ 0.8	67.2 $\pm$ 1.0	67.3 $\pm$ 1.1	67.4 $\pm$ 1.0
65.0 — 66.5″ at		65.6 $\pm$ 0.4	67. $\pm$ 0.6	67.4 $\pm$ 0.8	67.6 $\pm$ 0.7	67.6 $\pm$ 0.6
66.0 — 67.5″ at			67.0 $\pm$ 0.4	67.4 $\pm$ 0.4	67.6 $\pm$ 0.5	68.0 $\pm$ 0.5
67.0 — 68.5″ at				67.5 $\pm$ 0.35	68.0 $\pm$ 0.45	68.1 $\pm$ 0.45
68.0 — 69.5″ at					68.5 $\pm$ 0.3	68.7 $\pm$ 0.40
68.5 — 70.1						69.3 $\pm$ 0.42

b. Tall Group.

Inches.	16 years.	17 years.	18 years.	19 years.	20 years.	22 years.
67.0 — 69.″ at	68.0 $\pm$ 0.49	68.7 $\pm$ 0.62	69.2 $\pm$ 0.68	60.5 $\pm$ 0.76	69.8 $\pm$ 0.79	70.0 $\pm$ 0.75
67.5 — 69.5 at		68.4 $\pm$ 0.56	69.2 $\pm$ 0.64	69.4 $\pm$ 0.74	69.6 $\pm$ 0.67	69.7 $\pm$ 0.62
68. — 70. at			69.3 $\pm$ 0.49	69.2 $\pm$ 0.56	69.4 $\pm$ 0.55	69.7 $\pm$ 0.54
68.5 — 70.5 at				69.4 $\pm$ 0.40	69.6 $\pm$ 0.42	69.7 $\pm$ 0.44
69.0 — 71.0 at					69.7 $\pm$ 0.40	69.8 $\pm$ 0.42
69.5 — 71.0 at						70.0 + 0.26

Table XVIII.

Individual Increases in Height.

a. Short Group. *b.* Tall Group.

Inches.	*a.* Years. 16–17	17–18	18–19	19–20	20–22	*b.* Years. 16–17	17–18	18–19	19–20	20–22
.6		1.								
.5										
.4		1.								
.3										
.2										
.1	1.									
3	1.	1.								
.7	3.	1.								
.6	2.	1.								
.5	1.									
.4	2.									
.3	1.	1.	1.							
.2	4.									
.1	2.									
2	2.	1.								
.7	1.	3.	2.							
.6	3.	2.								
.5	2.	2.		1.		2.				
.4	2.	1.			1.	3.				
.3	5.	4.	2.			3.				
.2	2.	4.	1.		1.	4.	1.			
.1	3.	2.	1.			3.	2.			
1	3.	6.	3.	1.		7.	2.	1.	1.	
.7	3.	4.	3.	1.		4.	2.	1.		
.6	1.	3.	5.		1.	4.	8.	2.	1.	
.5	2.	1.	5.	2.	1.	11.	5.	2.	2.	2.
.4	1.	4.	8.	3.	6.	6.	10.	5.	1.	2.
.3		1.	8.	15.	4.		7.	10.	10.	4.
.2		2.	3.	8.	3.	4.	10.	11.	10.	9.
+ .1		1.	4.	7.	13.	4.	4.	6.	16.	8.
0	1.	1.	5.	6.	8.	2.	9.	21.	13.	19.
— .1				1.	3.				2.	8.
.2			1.						1.	2.
Total No.	48.	48.	52.	45.	42.	57.	60.	61.	57.	54.

TABLE XIX. The Height.

Age at nearest Birthday.	No. of observations.	Values in Inches at the following Percentile Grades.										
		5	10	20	30	40	50	60	70	80	90	95
15	131	59.507	60.310	61.563	62.553	63.457	64.290	64.855	65.764	66.653	67.717	69.290
16	395	61.750	62.549	63.714	64.580	65.250	65.805	66.455	67.200	68.020	69.000	70.406
17	722	63.130	64.217	65.165	65.853	66.434	67.000	67.626	68.317	69.100	70.320	71.320
18	841	64.193	65.000	65.886	66.483	67.044	67.633	68.251	68.920	69.665	70.520	71.530
19	750	64.680	65.391	66.250	66.844	67.424	67.651	68.600	69.243	69.786	71.000	71.880
20	645	64 962	65.543	66.413	67.094	67.675	68.252	68.810	69.477	70.253	71.280	72.120
21	493	64.970	65.620	66.433	67.054	67.667	68.215	68.852	69.483	70.180	71.120	72.000
22	328	64.945	65.831	66.580	67.200	67.762	68.352	68.960	69.927	70.632	71.543	72.258
23	232	65.287	65.800	66.580	67.300	68.010	68.522	69.030	69.625	70.307	71.240	72.000

TABLE XX. The Weight.

Age at nearest Birthday.	No. of observations.	Values in Pounds at the following Percentile Grades.										
		5	10	20	30	40	50	60	70	80	90	95
15	131	80.0	85.3	93.0	98.8	103.8	108.5	112.6	116.5	120.5	127.3	132.0
16	395	94.0	98.6	103.6	108.9	114.2	116.9	121.4	125.4	130.5	137.1	146.2
17	722	102.4	106.5	112.0	116.9	121.0	124.8	128.5	132.5	137.5	144.3	151.6
18	841	109.2	113.3	120.0	123.9	127.9	131.8	135.9	140.0	146.0	153.6	158.0
19	750	114.3	120.0	124.8	129.5	133.3	137.0	142.1	145.3	149.7	158.0	165.1
20	645	116.0	125.2	126.5	131.2	134.9	138.5	142.5	146.9	152.3	160.9	167.8
21	493	117.7	122.0	127.0	131.6	135.3	138.9	143.0	147.2	152.6	160.7	167.3
22	328	117.2	122.1	128.0	132.1	135.3	138.7	142.9	147.8	153.5	160.0	163.1
23	232	118.0	122.2	126.7	131.0	134.7	138.3	142.2	146.4	151.8	163.8	170.0

TABLE XXI. The Height, Sitting.

Age at nearest Birthday.	No. of observations.	Values in Inches in the following Percentile Grades.										
		5	10	20	30	40	50	60	70	80	90	95
15												
16	110	31.050	31.600	32.270	32.692	33.110	33.500	33.893	34.285	34.680	35.150	35.577
17	225	32.008	32.400	33.083	33.460	33.833	34.180	34.500	34.821	35.240	35.800	36.135
18	243	32.915	33.174	33.548	33.921	34.278	34.630	35.000	35.044	35.677	36.074	36.602
19	200	33.050	33.333	33.889	34.307	34.700	35.055	35.333	35.611	35.888	36.462	36.850
20	165	35.185	33.543	34.150	34.562	34.975	35.254	35.528	35.800	36.137	36.707	37.000
21	103	33.643	34.100	34.549	34.995	35.222	35.445	35.670	35.893	36.235	36.683	36.907
22	68	33.266	33.644	34.225	34.675	35.050	35.320	35.592	35.864	36.309	36.927	37.433
23	46	34.018	34.288	34.450	34.737	35.026	35.333	35.640	35.946	36.300	36.646	36.823

TABLE XXII. The Perineal Height.

Age at nearest Birthday.	No. of observations.	Values in Inches in the following Percentile Grades.										
		5	10	20	30	40	50	60	70	80	90	95
15	90	29.545	31.000	31.644	32.120	32.650	33.125	33.500	33.875	34.461	35.222	35.722
16	235	31.150	31.520	32.368	32.987	33.411	33.830	34.245	34.657	35.118	35.808	36.477
17	409	32.084	32.583	33.287	33.780	34.213	34.600	35.000	35.401	36.121	36.537	37.030
18	490	32.500	33.135	33.800	34.260	34.634	35.007	35.357	35.707	36.110	36.781	37.314
19	454	33.033	33.480	34.150	34.525	34.800	35.243	35.560	35.874	36.331	36.885	37.554
20	395	33.209	33.679	34.245	34.618	35.000	35.310	35.629	36.071	36.440	36.970	37.720
21	318	32.926	33.450	34.180	34.600	35.012	25.340	35.670	36.000	36.483	36.972	37.670
22	212	33.270	33.771	34.348	34.800	35.176	35.492	35.810	36.221	36.779	37.500	37.900
23	160	33.500	34.090	33.576	35.040	35.350	35.654	35.961	36.535	36.700	37.177	37.650

TABLE XXIII.

The Circumference of the Chest midway between Inspiration and Expiration.

Age at nearest Birthday.	No. of observations.	Values in Inches in the following Percentile Grades.										
		5	10	20	30	40	50	60	70	80	90	95
15	132	26.600	27.262	28.070	28.700	29.300	29.952	30.470	31.063	31.664	32.483	33.000
16	395	27.980	28.464	29.333	30.071	30.584	31.101	31.635	32.000	32.712	33.513	34.150
17	722	28.740	29.170	30.480	31.061	31.478	31.895	32.324	32.751	33.347	34.221	34.843
18	841	30.028	30.588	31.322	31.832	32.275	32.685	33.135	33.715	34.354	35.100	35.813
19	750	30.814	31.300	32.011	32.428	32.844	33.250	33.710	34.184	34.735	35.481	35.944
20	645	31.078	31.500	32.153	32.700	33.165	33.588	34.000	34.489	34.960	35.804	36.576
21	496	31.152	31.580	32.280	32.720	33.270	33.656	34.055	34.546	35.060	35.834	36.680
22	328	31.231	31.744	32.384	32.900	33.345	33.776	34.208	34.640	35.142	36.000	36.873
23	232	31.255	31.900	32.474	33.029	33.451	33.873	34.265	34.646	35.055	35.855	36.822

TABLE XXIV.

The Lung-capacity ascertained by means of the Spirometer.

Age at nearest Birthday.	No. of observations.	Values in Cubic Inches in the following Percentile Grades.										
		5	10	20	30	40	50	60	70	80	90	95
15	132	117.2	132.0	148.4	156.4	166.2	178.2	190.0	198.9	205.5	219.5	233.5
16	395	143.2	152.1	166.8	176.3	185.9	193.5	199.4	210.7	224.0	237.0	253.5
17	722	156.4	171.0	181.9	192.7	198.8	208.8	216.8	228.5	238.8	252.7	263.1
18	841	170.0	180.0	192.3	203.5	212.5	219.0	227.7	236.0	245.7	260.0	272.2
19	750	181.0	192.3	203.3	213.2	220.8	228.3	235.6	243.4	253.1	268.6	287.0
20	645	185.6	194.3	206.9	215.8	224.0	233.2	242.0	249.6	261.0	277.6	290.7
21	493	185.7	194.6	207.0	219.5	224.1	232.2	240.0	248.3	259.0	277.4	287.5
22	328	194.0	203.4	214.5	222.5	231.1	237.9	245.8	254.6	263.8	286.5	298.5
23	232	194.7	204.0	211.5	221.0	230.0	236.3	245.3	255.1	264.6	276.2	285.5

TABLE XXV.

The Span, in Inches, of the Arms.

Age at nearest Birthday.	No. of observations.	Values in the following Percentile Grades.										
		5	10	20	30	40	50	60	70	80	90	95
15	33	60.65	61.65	62.52	63.25	64.05	64.50	64.97	65.55	67.48	68.35	68.78
16	110	60.90	63.00	64.54	65.42	66.25	66.80	67.44	68.15	69.00	70.25	71.83
17	225	63.61	64.61	65.74	66.57	67.27	67.90	68.54	69.27	70.24	71.54	72.57
18	243	64.47	65.23	66.16	67.14	67.91	68.55	69.23	69.81	70.80	72.12	73.00
19	200	64.45	65.66	66.90	67.60	68.34	69.03	69.64	70.40	71.35	72.50	73.55
20	165	64.88	66.13	67.15	67.97	68.70	69.40	70.12	71.07	71.82	73.34	73.80
21	103	65.30	67.03	68.12	68.91	69.44	69.93	70.63	71.32	71.96	73.34	74.62
22	68	65.10	66.00	67.20	68.05	68.90	69.60	70.35	71.23	72.28	73.80	74.43
23	46	67.05	67.43	68.60	69.27	69.60	69.93	70.60	71.27	71.85	72.85	73.85

TABLE XXVI.

The Circumference, in Inches, of the Waist.

Age at nearest Birthday.	No. of observations.	Values in the following Percentile Grades.										
		5	10	20	30	40	50	60	70	80	90	95
15	134	21.67	22.67	23.50	24.09	24.62	25.12	25.53	25.93	26.53	27.60	28.61
16	395	23.23	23.75	24.47	25.06	25.41	25.77	26.18	26.71	27.31	27.97	28.80
17	722	23.84	24.38	25.13	25.57	26.00	26.45	26.90	27.42	27.96	28.78	29.48
18	841	24.21	24.86	25.69	26.28	26.75	27.22	27.70	28.21	28.59	29.68	30.43
19	750	24.33	25.20	26.03	26.60	27.15	27.60	28.05	28.53	29.02	29.82	30.65
20	645	24.68	25.32	26.19	26.83	27.32	27.98	28.26	28.53	29.58	30.66	31.40
21	493	24.58	25.23	26.07	26.66	27.21	27.69	28.21	28.85	29.62	30.54	31.19
22	328	25.09	25.53	26.24	26.76	27.28	27.81	28.35	28.91	29.46	30.25	31.00
23	232	24.87	25.53	26.40	27.03	27.46	27.89	28.48	29.13	29.84	30.85	31.70

TABLE XXVII.

Right Hand Squeeze in Pounds.

Age at nearest Birthday.	No. of observations.	Values at the following Percentile Grades.										
		5	10	20	30	40	50	60	70	80	90	95
15	46	38.0	40.6	46.3	53.0	58.6	60.0	64.0	68.0	70.3	79.0	80.0
16	120	51.0	55.5	59.0	62.1	65.2	68.0	70.7	73.5	76.8	81.2	90.0
17	225	57.1	60.7	66.1	70.0	72.5	75.2	78.0	81.0	84.2	89.4	94.0
18	243	62.8	65.7	68.0	70.4	74.5	77.2	80.1	83.1	86.6	91.7	96.8
19	200	65.6	68.8	72.6	75.9	78.8	82.0	85.2	88.1	91.6	97.6	102.5
20	165	66.2	69.7	74.7	77.8	80.3	83.8	86.8	89.8	95.2	99.0	103.0
21	103	67.1	71.0	75.6	79.6	82.7	85.8	89.5	92.7	96.7	102.1	107.0
22	68	66.0	68.4	72.5	77.0	81.6	85.0	87.1	89.2	94.4	98.9	105.0
23	46	68.9	72.0	78.6	83.8	86.7	89.0	92.1	95.5	97.6	99.7	107.1

TABLE XXVIII.

Left Hand Squeeze in Pounds.

Age at nearest Birthday.	No. of observations.	Values in the following Percentile Grades.										
		5	10	20	30	40	50	60	70	80	90	95
15	36	33.0	36.0	43.0	49.6	54.2	56.4	58.0	59.6	64.6	71.0	75.5
16	110	45.0	50.9	55.6	59.0	62.1	65.0	66.7	68.6	72.0	80.0	85.0
17	225	55.0	58.9	64.7	68.6	71.6	73.5	76.1	79.4	82.7	87.5	92.7
18	245	57.5	61.6	66.5	69.0	71.6	75.0	77.6	80.0	84.5	89.2	94.8
19	200	64.4	66.8	70.8	74.4	78.3	81.5	83.1	86.1	89.5	96.3	99.6
20	165	63.3	66.8	71.9	76.0	79.3	82.0	84.6	90.0	94.0	99.4	104.2
21	103	67.7	71.5	75.7	78.8	81.7	84.5	87.3	90.0	93.7	99.7	104.8
22	68	65.2	67.1	72.0	77.0	80.0	83.8	86.8	89.4	94.5	99.4	103.2
23	46	66.5	69.0	77.2	80.4	82.7	85.0	87.3	89.6	92.3	97.2	104.2

TABLE XXIX.
The Absolute Annual Increase in Weight in Pounds.

Age at nearest Birthday.	Values in the following Percentile Grades.										
	5	10	20	30	40	50	60	70	80	90	95	Average.
15-16	14.0	13.3	10.6	10.1	11.4	8.4	8.8	8.9	10.0	9.8	14.2	11.0
16-17	8.4	7.9	8.4	8.0	6.8	7.9	7.1	7.1	7.0	7.2	5.4	7.0
17-18	6.8	6.8	8.0	7.0	6.9	7.0	7.4	7.5	8.5	9.3	6.4	8.4
18-19	5.1	6.7	4.8	5.6	5.4	5.3	6.2	5.3	3.7	5.4	7.1	6.32
19-20	1.7	5.2	1.7	1.7	1.6	1.5	0.4	1.6	2.6	2.9	2.7	1.5
20-21	1.7	3.2	0.5	0.4	0.4	0.4	0.5	0.3	0.3	—0.2	—0.5	—1.2
21-22	—0.5	0.1	1.0	0.5	0.0	—0.2	—0.1	0.6	0.9	—0.7	—4.2	—1.3
22-23	2.8	0.1	1.3	—1.1	—0.6	—0.4	—0.7	—1.4	—1.7	3.8	6.9	2.7

TABLE XXX.
The Absolute Annual Increase in Height, Standing.

Age at nearest Birthday.	Values in Inches in the following Percentile Grades.										
	5	10	20	30	40	50	60	70	80	90	95	Average.
15-16	2.243	2.239	1.151	2.027	1.793	1.515	1.570	1.536	1.367	1.283	1.177	2.13
16-17	1.380	1.668	1.451	1.273	1.184	1.195	1.172	1.117	1.080	1.320	0.914	1.12
17-18	1.063	1.283	0.721	0.630	0.610	0.633	0.624	0.603	0.565	0.200	0.210	0.24
18-19	0.487	0.391	0.364	0.361	0.380	0.018	0.349	0.323	0.121	0.480	0.350	0.61
19-20	0.282	0.152	0.163	0.250	0.251	0.601	0.210	0.234	0.467	0.280	0.240	0.65
20-21	0.008	0.077	0.020	—0.040	—0.008	—0.037	0.042	0.006	—0.073	—0.160	—0.120	0.05
21-22	—0.025	0.211	0.147	0.146	0.095	0.137	0.108	0.444	0.452	0.423	0.258	—0.15
22-23	0.342	—0.031	0.000	0.100	0.248	0.170	0.070	—0.302	—0.325	—0.303	—0.258	0.17

TABLE XXXI.
The Absolute Annual Increase in Height, Sitting.

Age at nearest Birthday.	Values in Inches in the following Percentile Grades.										
	5	10	20	30	40	50	60	70	80	90	95	Average.
16-17	0.958	0.800	0.813	0.768	0.723	0.680	0.607	0.536	0.560	0.650	0.558	0.50
17-18	0.907	0.774	0.465	0.461	0.445	0.450	0.500	0.223	0.437	0.274	0.467	0.75
18-19	0.135	0.159	0.341	0.386	0.422	0.425	0.333	0.567	0.211	0.388	0.248	0.75
19-20	0.135	0.210	0.261	0.255	0.275	0.199	0.195	0.189	0.249	0.245	0.150	0.73
20-21	0.458	0.557	0.399	0.433	0.247	0.191	0.142	0.093	0.098	—0.024	—0.093	—0.23
21-22	—3.77	—0.456	—0.324	—0.320	—0 172	—0.125	—0.078	—0.029	0.074	0.244	0.526	0.00
22-23	0.752	0.644	0.225	0.062	—0.024	0.013	0.048	0.082	—0.009	—0.281	0.390	0.00

TABLE XXXII.
The Absolute Annual Increase in Perineal Height.

Age at nearest Birthday.	Values in Inches in the following Percentile Grades.										
	5	10	20	30	40	50	60	70	80	90	95	Average.
15-16	1.605	0.220	0.724	0.867	0.761	0.705	0.745	0.782	0.657	0.586	0.755	1.20
16-17	0.934	1.363	0.919	0.793	0.802	0.770	0.745	0.744	1.003	0.729	0.553	0.80
17-18	0.416	0.552	0.513	0.480	0.421	0.407	0.357	0.306	0.091	0.244	0.284	0.60
18-19	0.533	0.345	0.350	0.265	0.166	0.236	0.203	0.167	0.221	0.104	0.240	1.30
19-20	0.166	0.199	0.095	0.093	0.200	0.067	0.069	0.197	0.109	0.085	0.166	—0.90
20-21	—0.273	—0.229	—0.065	—0.018	0.012	0.030	0.041	—0.071	0.043	0.002	—0.050	—1.00
21-22	0.344	0.321	0.168	0.200	0.164	0.152	0.140	0.221	0.296	0.528	0.230	1.00
22-23	0.220	0.319	0.228	0.240	0.174	0.162	0.151	0.314	—0.079	—0.323	— .025	0.00

TABLE XXXIII.
The Absolute Annual Increase in Circumference of Chest.

Age at nearest Birthday.	Values in Inches in the following Percentile Grades.										
	5	10	20	30	40	50	60	70	80	90	95	Average.
15-16	1.383	1.202	1.263	1.371	1.284	1.149	1.165	0.937	1.048	1.030	1.150	1.17
16-17	0.757	0.706	1.147	0.990	0.894	0.794	0.689	0.751	0.635	0.708	0.693	0.83
17-18	1.288	1.418	0.942	0.771	0.797	0.790	0.811	0.964	1.007	0.879	0.970	0.94
18-19	0.786	0.712	0.689	0.596	0.569	0.565	0.575	0.469	0.381	0.381	0.131	1.54
19-20	0.264	0.200	0.142	0.272	0.321	0.338	0.290	0.305	0.235	0.323	0.532	—0.70
20-21	0.074	0.080	0.127	0.020	0.105	0.068	0.055	0.057	0.100	0.030	0.104	0.00
21-22	0.079	0.164	0.104	0.180	0.075	0.120	0.153	0.106	0.082	0.166	0.193	0.05
22-23	0.024	0.156	0.090	0.129	0.066	0.097	0.057	0.006	—0.087	—0.145	—0.051	0.45

TABLE XXXIV.
The Absolute Annual Increase in Lung-capacity. (Spirometer.)

Age at nearest Birthday.	Values in Cubic Inches in the following Percentile Grades.										
	5	10	20	30	40	50	60	70	80	90	95	Average.
15-16	26.0	20.1	18.4	19.9	19.7	15.3	9.4	11.8	18.5	17.5	20.0	18.0
16-17	13.2	18.9	15.1	16.4	12.9	15.3	17.4	17.8	14.8	15.7	9.6	16.0
17-18	14.4	9.0	10.4	10.8	13.7	10.2	10.9	8.5	6.9	7.3	9.1	9.0
18-19	11.0	12.3	11.0	9.7	8.3	9.3	7.9	7.4	7.4	8.6	14.8	14.0
19-20	4.6	2.0	3.6	2.6	3.2	5.9	6.4	6.2	7.9	9.0	3.7	—1.0
20-21	0.1	0.3	0.1	3.7	0.1	0.0	—2.0	—1.3	—2.0	— 1.02	— 3.2	2.0
21-22	8.3	8.8	7.5	2.0	7.0	5.7	5.8	6.3	4.8	19.1	11.0	5.0
22-23	0.7	0.6	3.0	—1.5	—1.1	—1.6	—0.5	0.5	0.8	—10.3	—13.0	—4.0

TABLE XXXV.
The Absolute Annual Increase in Circumference of Waist.

e at nearest Birthday.	Values in Inches in the following Percentile Grades.											
	5	10	20	30	40	50	60	70	80	90	95	Average.
15-16	1.56	1.08	0.97	0.97	0.79	0.65	0.65	0.78	0.78	0.37	0.19	0.91
16-17	0.61	0.63	0.66	0.51	0.59	0.68	0.72	0.71	0.65	0.81	0.68	1.36
17-18	0.37	0.48	0.56	0.71	0.75	0.77	0.80	0.79	0.63	0.90	0.95	0.54
18-19	0.12	0.34	0.34	0.32	0.40	0.38	0.35	0.32	0.43	0.14	0.22	0.30
19-20	0.35	0.12	0.16	0.23	0.17	0.38	0.21	0.30	0.56	0.84	0.75	0.02
20-21	—0.10	—0.09	—0.12	—0.17	—0.11	—0.29	—0.05	0.02	0.04	—0.12	—0.21	0.06
21-22	0.51	0.30	0.17	0.10	0.07	0.12	0.14	0.06	—0.16	—0.29	—0.19	0.12
22-23	—0.22	0.00	0.16	0.27	0.18	0.08	0.13	0.22	0.38	0.50	0.70	0.40

TABLE XXXVI.
The Absolute Annual Increase in the Span of Arms.

e at nearest Birthday.	Values in Inches in the following Percentile Grades.											
	5	10	20	30	40	50	60	70	80	90	95	Average.
15-16	0.25	1.35	2.02	2.17	2.20	2.30	2.47	2.60	1.52	1.90	3.05	3.43
16-17	2.71	1.61	1.20	1.15	1.02	1.10	1.10	1.12	1.24	1.29	0.74	0.77
17-18	0.86	0.62	0.42	0.67	0.64	0.65	0.69	0.54	0.56	0.58	0.46	1.25
18-19	—0.02	0.43	0.74	0.46	0.43	0.48	0.41	0.59	0.55	0.32	0.55	0.80
19-20	0.43	0.47	0.25	0.37	0.36	0.37	0.48	0.67	0.47	0.84	0.25	—0.02
20-21	0.42	0.90	0.97	0.94	0.74	0.53	0.51	0.25	0.14	0.00	0.82	0.57
21-22	—1.20	—1.03	—0.92	—0.86	—0.54	—0.33	—0.28	—0.09	0.32	0.44	—0.19	—0.47
22-23	2.95	1.43	1.40	1.22	0.70	0.33	0.25	—0.06	—0.43	—0.95	—0.58	—0.80

TABLE XXXVII.
The Absolute Annual Increase in Right Hand Squeeze.

e at nearest Birthday.	Values in Pounds in the following Percentile Grades.											
	5	10	20	30	40	50	60	70	80	90	95	Average.
15-16	13.0	14.9	12.7	9.1	6.6	8.0	6.7	5.5	6.5	3.1	10.0	10.50
16-17	6.1	5.2	7.1	7.9	7.3	7.2	7.3	7.5	7.4	7.3	4.0	5.97
17-18	5.7	5.0	1.9	0.4	2.0	2.3	2.1	2.1	2.4	2.3	2.8	3.53
18-19	2.8	3.1	4.6	5.5	4.3	4.5	5.1	5.0	5.0	5.9	5.7	4 00
19-20	0.6	0.9	2.1	1.9	1.5	1.8	1.6	1.7	3.6	1.4	1.2	2.00
20-21	0.9	1.3	0.9	1.8	2.4	2.0	2.7	2.9	1.5	3.1	3.3	1.00
21-22	—1.1	2.6	—3.1	—2.6	—1.1	—0.8	—2.4	—3.5	—2.3	—3.2	—2.0	—1.50
22-23	2.9	3.6	6.1	6.8	5.1	4.0	5.0	6.3	3.2	0.8	2.1	0.10

TABLE XXXVIII.
The Absolute Annual Increase in Left Hand Squeeze.

e at nearest Birthday.	Values in Pounds in the following Percentile Grades.											
	5	10	20	30	40	50	60	70	80	90	95	Average
15-16	12.0	14.9	12.6	9.4	7.9	8.6	8.7	9.0	7.4	9.0	9.5	10.0
16-17	10.0	8.0	9.1	9.6	9.5	8.5	9.4	10.8	10.7	7.5	7.7	6.6
17-18	2.1	2.7	1.8	0.4	0.0	1.5	1.5	0.6	1.8	1.7	2.1	3.4
18-19	7.3	5.2	4.3	5.4	6.7	6.5	5.5	6.1	5.0	7.1	4.8	3.0
19-20	—1.1	0.0	1.1	1.6	1.0	0.5	1.5	3.9	4.5	3.1	4.6	2.0
20-21	4.3	4.7	3.8	2.8	2.4	2.5	2.7	0.0	—0.3	0.3	0.6	2.4
21-22	—2.5	—4.4	—3.7	—1.8	—1.7	—0.7	—0.5	—0.6	0.8	—0.3	—1.6	—1.6
22-23	1.3	1.9	5.2	3.4	2.7	1.2	0.5	0.2	—2.2	—2.2	1.0	—1.1

TABLE XXXIX.
The Relative Annual Increase in Weight. (Pounds.)

e at nearest Birthday.	Values in Per Cent. in the following Percentile Grades.											
	5	10	20	30	40	50	60	70	80	90	95	Average.
15-16	13.1	12.4	10.0	9.4	10.6	8.0	8.2	8.3	9.3	9.2	13.2	10.3
16-17	7.1	6.7	7.1	6.8	5.8	6.7	6.0	6.0	6.0	6.0	4.6	6.0
17-18	5.4	5.4	6.4	5.6	5.5	5.6	6.0	6.0	6.8	7.4	5.1	6.7
18-19	3.8		3.7	4.2	4.0	4.0	4.7	4.0	2.3	4.0	5.3	5.0
19-20	1.2	3.7	1.2	1.2	1.1	1.1	0.3	1.1	1.8	2.1	2.0	1.1
20-21	1.2	2.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	—0.1	—0.3	—0.8
21-22	—0.4	0.1	0.7	0.4	0.0	—0.4	—0.1	0.4	0.6	—0.5	—3.0	—1.0
22-23	2.0	0.1	—0.9	—0.8	—0.4	—0.3	—0.5	—1.0	—1.2	2.7	4.9	2.0

TABLE XL.
The Relative Annual Increase in Height, Standing. (Inches.)

ge at nearest Birthday.	Values in Per Cent. at the following Percentile Grades.											
	5	10	20	30	40	50	60	70	80	90	95	Average.
15-16	3.51	3.51	1.80	3.17	2.72	2.37	2.41	2.41	2.14	2.01	1.84	3.34
16-17	2.09	2.53	2.20	1.93	1.79	1.81	1.79	1.71	1.64	2.02	1.08	1.70
17-18	1.58	1.91	1.07	0.93	0.91	0.93	0.93	0.90	0.83	0.30	0.31	0.36
18-19	0.72	0.58	0.54	0.53	0.56	0.03	0.52	0.47	0.17	0.72	0.52	0.91
19-20	0.41	0.22	0.24	0.37	0.37	0.88	0.30	0.34	0.68	0.41	0.35	0.95
20-21	0.001	0.01	0.003	—0.058	—0.012	—0.058	0.061	0.008	—0.107	—0.232	—0.175	0.073
21-22	—0.036	0.307	0.214	0.214	0.138	0.200	0.157	0.647	0.647	0.616	0.367	—0.215
22-23	0.500	—0.045	0.000	0.146	0.362	0.248	0.102	—0.441	—0.474	—0.442	—0.377	0.248

Table XLI.

The Relative Annual Increase in Height, Sitting. (Inches.)

Age at nearest Birthday.	Values in Per Cent. at the following Percentile Grades.										
	5	10	20	30	40	50	60	70	80	90	95	Average
16–17	2.87	2.40	2.44	2.30	2.17	2.04	1.82	1.61	1.68	1.95	1.95	1.50
17–18	2.60	2.21	1.30	1.30	1.27	1.21	1.43	0.64	1.25	0.78	1.30	2.14
18–19	0.38	0.44	0.95	1.08	1.18	1.18	0.93	1.58	0.59	1.08	0.69	2.10
19–20	0.37	0.60	0.71	0.70	0.75	0.52	0.52	0.50	0.68	0.68	0.41	2.00
20–21	1.23	1.55	1.11	1.21	0.69	0.53	0.39	0.27	0.29	−0.08	−0.27	−0.62
21–22	−1.05	−1.26	−0.90	−0.90	−0.48	−0.35	−0.21	−0.08	0.20	0.68	1.46	0.00
22–23	2.10	1.80	0.62	0.17	−0.07	0.03	0.13	0.23	−0.02	−0.77	1.08	0.00

Table XLII.

The Relative Annual Increase in Perineal Height. (Inches.)

Age at nearest Birthday.	Values in Per Cent. at the following Percentile Grades.										
	5	10	20	30	40	50	60	70	80	90	95	Average
15–16	5.00	0.70	2.26	2.71	2.30	2.20	2.33	2.44	2.05	1.83	2.36	3.80
16–17	2.81	4.10	2.16	2.38	2.41	2.32	2.24	2.24	3.02	2.20	1.70	2.41
17–18	1.22	1.62	1.51	1.41	1.24	1.20	1.05	0.90	0.30	0.72	0.84	1.77
18–19	1.54	1.00	1.01	0.74	0.48	0.69	0.58	0.47	0.64	0.30	0.70	3.76
19–20	0.46	0.55	0.26	0.26	0.58	0.19	0.19	0.55	0.30	0.24	0.46	−2.50
20–21	−0.40	−0.33	−0.09	−0.027	0.020	0.04	0.103	−0.10	0.06	0.003	−0.07	−1.459
21–22	0.96	0.89	0.47	0.57	0.47	0.42	0.39	0.61	0.82	1.46	0.64	2.77
22–23	0.61	0.88	0.64	0.66	0.50	0.45	0.42	0.90	−0.22	−0.90	−0.89	0.00

Table XLIII.

The Relative Annual Increase in Circumference of Chest. (Inches.)

Age at nearest Birthday.	Values in Per Cent. at the following Percentile Grades.										
	5	10	20	30	40	50	60	70	80	90	95	Average
15–16	4.54	3.93	4.14	4.50	4.21	3.77	3.82	3.62	3.40	3.37	3.77	3.83
16–17	2.39	2.23	3.62	3.12	2.82	2.50	2.17	2.38	2.01	2.23	2.19	2.62
17–18	3.96	4.36	2.90	2.37	2.45	2.44	2.50	2.97	3.09	2.70	2.97	2.90
18–19	2.34	2.13	2.06	1.78	1.70	1.70	1.72	1.41	1.14	1.14	0.40	4.60
19–20	0.75	0.57	0.40	0.80	0.91	0.96	0.85	0.90	0.67	0.92	1.52	−2.00
20–21	0.21	0.23	0.37	0.06	0.30	0.20	0.16	0.16	0.30	0.09	0.30	0.00
21–22	0.23	0.47	0.30	0.52	0.21	0.36	0.44	0.30	0.23	0.47	0.56	0.02
22–23	0.07	0.45	0.26	0.36	0.19	0.28	0.16	0.01	−0.25	−0.42	−0.15	1.40

Table XLIV.

The Relative Annual Increase in Lung Capacity. (Cb. Inches.)

Age at nearest Birthday.	Values in Per Cent. at the following Percentile Grades.										
	5	10	20	30	40	50	60	70	80	90	95	Average
15–16	14.2	10.1	11.0	11.0	11.0	8.3	5.1	6.4	10.1	9.5	11.0	10.0
16–17	6.5	7.5	9.4	8.1	6.4	7.6	8.6	8.9	7.3	7.8	4.7	8.0
17–18	6.6	4.8	4.1	5.0	6.3	4.7	5.0	4.0	3.2	3.3	4.2	4.1
18–19	4.8	4.8	5.4	4.3	3.7	4.1	3.5	3.3	3.3	3.8	6.6	6.2
19–20	1.9	1.5	0.8	1.1	1.3	2.5	2.7	2.2	3.3	3.8	1.6	−0.4
20–21	0.04	0.04	0.12	1.60	0.04	0.00	−0.83	−0.54	−0.84	−0.43	−1.34	0.84
21–22	3.40	3.11	3.65	0.83	2.90	2.37	2.37	2.61	2.00	7.39	4.60	2.08
22–23	0.28	−1.22	0.24	−0.60	−0.45	−0.60	−0.20	0.20	0.32	−4.20	−5.29	−1.62
		20 P. G.	10 P. G.									

Table XLV.

The Relative Annual Increase in Circumference of Waist. (Inches.)

Age at nearest Birthday.	Values in Per Cent. at the following Percentile Grades.										
	5	10	20	30	40	50	60	70	80	90	95	Average
15–16	6.21	4.30	3.86	3.86	3.15	2.35	2.35	3.15	3.50	1.50	0.75	3.63
16–17	2.35	2.42	2.54	2.00	2.27	2.64	2.77	2.77	2.50	3.11	2.64	5.23
17–18	1.34	1.75	2.04	2.59	2.73	2.81	2.92	2.90	2.30	3.28	2.81	2.00
18–19	0.43	1.22	1.22	1.11	1.43	1.36	1.25	1.11	1.54	0.50	0.80	1.08
19–20	1.23	0.42	0.56	0.80	0.59	1.33	0.73	1.50	2.00	3.00	2.62	0.07
20–21	−0.35	−0.31	−0.42	−0.60	−0.39	−1.01	−0.17	0.07	0.14	−0.42	−0.73	0.21
21–22	1.77	1.04	0.60	0.34	0.24	0.42	0.49	0.21	−0.55	−1.01	−0.66	0.41
22–23	−0.76	0.00	0.55	0.93	0.62	0.28	0.45	0.76	1.32	1.73	2.42	1.40

TABLE XLVI.
The Relative Annual Increase in Span of Arms. (Inches.)

Age at nearest Birthday.	Values in Per Cent. at the following Percentile Grades.											
	5	10	20	30	40	50	60	70	80	90	95	Average.
15-16	0.39	2.11	3.15	3.86	3.58	3.60	3.86	4.10	2.38	2.97	4.76	5.37
16-17	4.04	2.40	1.78	1.71	1.51	1.63	1.63	1.64	1.79	1.80	1.00	1.14
17-18	1.26	0.91	0.61	1.00	0.95	0.95	1.01	0.71	0.72	0.72	0.63	1.83
18-19	−0.02	0.62	1.06	0.66	0.62	0.67	0.61	0.85	0.79	0.46	0.79	1.15
19-20	0.61	0.67	0.35	0.52	0.51	0.52	0.68	0.95	0.67	1.19	0.35	−0.03
20-21	0.60	1.28	1.38	1.34	1.05	0.75	0.74	0.35	0.20	0.00	1.17	0.81
21-22	−1.70	−1.45	−1.30	−1.21	−0.76	−0.46	−0.40	−0.12	0.45	0.62	−0.27	−0.66
22-23	4.20	2.03	2.00	1.73	1.00	0.47	0.35	−0.08	−0.61	−1.35	−0.82	1.14

TABLE XLVII.
The Relative Annual Increase in Right Hand Squeeze. (Pounds.)

Age at nearest Birthday.	Values in Per Cent. at the following Percentile Grades.											
	5	10	20	30	40	50	60	70	80	90	95	Average.
15-16	21.3	24.4	20.8	15.0	10.8	13.1	11.0	9.0	10.6	5.1	16.4	17.2
16-17	8.5	7.2	10.0	11.0	10.2	10.1	10.2	10.5	10.3	10.2	5.6	8.3
17-18	7.3	6.4	2.4	0.5	2.6	3.00	2.7	2.7	3.1	3.0	3.6	4.5
18-19	3.5	3.8	5.7	6.8	5.3	5.5	6.3	6.2	6.2	7.3	7.0	5.0
19-20	0.7	1.0	2.4	2.2	1.7	2.1	1.8	2.0	4.2	1.6	1.4	2.3
20-21	1.0	1.5	1.0	2.1	2.7	2.3	3.1	3.3	1.7	3.5	3.8	1.1
21-22	−1.2	−3.00	−3.5	−3.0	−1.2	−0.9	−2.7	−4.0	−2.6	−3.6	−2.2	−1.7
22-23	3.3	4.2	7.3	7.8	5.9	4.6	5.8	7.4	3.7	0.9	2.4	0.1

TABLE XLVIII.
The Relative Annual Increase in Left Hand Squeeze. (Pounds.)

Age at nearest Birthday.	Values in Per Cent. at the following Percentile Grades.											
	5	10	20	30	40	50	60	70	80	90	95	Average.
15-16	20.0	25.0	21.0	16.0	13.1	14.3	14.5	15.0	12.3	15.0	15.1	16.6
16-17	14.3	11.4	13.0	13.7	13.5	12.1	13.4	15.4	15.3	10.7	11.0	9.1
17-18	2.7	3.5	2.3	0.5	0.0	2.0	2.0	0.8	2.3	2.2	2.7	4.4
18-19	9.1	6.5	5.4	6.7	8.4	8.1	7.0	7.6	6.2	8.8	6.0	3.8
19-20	−1.3	0.0	1.3	1.9	1.2	0.6	1.8	4.7	5.4	3.8	5.5	2.4
20-21	5.0	5.5	4.4	3.3	2.8	2.9	3.2	0.0	−0.3	0.3	0.7	2.8
21-22	−2.8	−5.0	−4.3	−2.1	−2.0	−0.8	−0.6	−0.7	0.9	−0.3	−1.8	−1.8
22-23	1.5	2.2	6.0	4.0	3.1	1.4	0.6	−0.2	−2.5	−2.5	1.2	−1.3

TABLE XLIX. The Height, Standing.

Age at nearest Birthday.	No. of Observations.	Unit of Measurement.	Average.	Probable Error of Average.	Probable Deviation.	Relation of Probable Deviation to Average.	Absolute Ann'l Increase of Average.	Relative Ann'l Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.
				E	d	d/A						
15	131		63.80	±0.136	±1.96	2.65%			62.058	64.290	66.208	+ 0.490
16	395		65.93	±0.080	±1.56	2.36	2.13	3.34%	64.147	65.850	67.610	− 0.125
17	722		67.05	±0.059	±1.59	2.37	1.12	1.70	65.509	67.000	68.708	− 0.050
18	841		67.29	±0.057	±1.68	2.50	0.24	0.36	66.184	67.633	69.292	+ 0.343
19	750		67.90	±0.054	±1.50	2.21	0.61	0.91	66.547	67.651	69.514	− 0.249
20	645		68.55	±0.060	±1.50	2.18	0.65	0.95	66.753	68.252	69.865	− 0.298
21	493		68.60	±0.071	±1.58	2.30	0.05	0.073	66.743	68.215	69.831	− 0.385
22	328		68.45	±0.086	±1.56	2.27	−0.15	−0.215	66.894	68.352	70.280	− 0.098
23	232		68.62	±0.099	±1.51	2.20	0.17	0.248	66.940	68.522	69.980	− 0.098

TABLE L. The Weight.

Age at nearest Birthday.	No. of Observations.	Unit of Measurement.	Average.	Probable Error of Average.	Probable Deviation.	Relation of Probable Deviation to Average.	Relation of Average to Height, Standing.	Absolute Ann'l Increase of Average.	Relative Ann'l Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.
				E	d	d/A							
15	131		107.0	±0.922	±10.60	10.0%	16.7%			95.9	108.5	118.5	+ 1.5
16	395		118.0	±0.531	±10.56	8.9	18.2	11.0	10.3%	106.2	116.9	127.8	− 1.1
17	722		125.0	±0.370	± 9.94	7.9	18.6	7.0	6.0	114.4	124.8	135.0	− 0.2
18	841		133.4	±0.400	±11.28	8.4	20.0	8.4	6.7	121.9	131.8	143.0	− 1.5
19	750		139.7	±0.360	± 9.86	7.0	20.5	6.3	5.0	127.1	137.0	147.5	− 2.7
20	695		141.2	±0.371	± 9.43	6.7	20.6	1.5	1.1	128.8	138.5	149.6	− 2.7
21	493		140.0	±0.456	±10.14	7.2	20.4	−1.2	−0.8	129.3	138.9	149.9	− 1.1
22	328		141.3	±0.500	± 9.07	6.4	20.6	−1.3	−1.0	130.1	138.7	150.6	− 2.6
23	232		144.0	±0.768	±11.81	8.2	21.0	2.7	2.0	128.9	138.3	149.1	− 5.7

TABLE LI. The Height, Sitting.

Age at nearest Birthday.	No. of Observations.	Unit of Measurement.	Average.	Probable Error of Average.	Probable Deviation.	Relation of Probable Deviation to Average.	Relation of Average to Height, Standing.	Absolute Ann'l Increase of Average.	Relative Ann'l Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.
				E	d	d/A							
15	131		33.3	±0.088	±1.01	3.03%	42.7%						
16	395		34.5	±0.048	±0.96	2.80	52.3			32.481	33.500	34.282	−1.000
17	722		35.0	±0.032	±0.86	2.46	52.5	0.50	1.50%	33.271	34.180	35.030	−0.820
18	841		35.7	±0.027	±0.81	2.27	53.0	0.75	2.14	33.735	34.630	35.360	−1.120
19	750		36.5	±0.035	±0.98	2.70	53.7	0.75	2.10	34.098	35.055	35.749	−1.445
20	695		35.7	±0.027	±0.70	1.96	52.1	0.73	2.00	34.356	35.254	35.967	−0.516
21	493		36.0	±0.024	±0.54	1.50	52.4	−0.23	−0.62	34.772	35.445	36.064	−0.555
22	328		36.0	±0.040	±0.74	2.05	52.5	0.00	0.00	34.450	35.320	36.087	−0.680
23	232		36.0	±0.036	±0.57	1.58	52.4	0.00	0.00	34.593	35.333	36.123	−0.667

TABLE LII. The Perineal Height.

Age at nearest Birthday.	No. of Observations.	Unit of Measurement.	Average.	Probable Error of Average.	Probable Deviation.	Relation of Probable Deviation to Average.	Relation of Average to Height, Standing.	Absolute Ann'l Increase of Average.	Relative Ann'l Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.
				E	d	d/A							
15	131		32.0	±0.131	±1.51	4.72%	50.1%			31.882	33.125	34.168	
16	395		33.2	±0.064	±1.29	3.89	53.5	1.20	3.80%	32.678	33.830	34.887	
17	722		34.0	±0.045	±1.25	3.67	50.7	0.80	2.41	33.531	34.600	35.761	
18	841		34.6	±0.040	±1.22	3.52	51.4	0.60	1.77	34.030	35.007	35.909	
19	750		35.9	±0.031	±0.86	2.40	52.8	1.30	3.76	34.338	35.243	36.102	
20	695		35.0	±0.038	±0.98	2.80	51.1	−0.90	2.50	34.431	35.310	36.256	
21	493		34.0	±0.076	±1.69	4.97	50.0	−1.00	−1.46	34.390	35.340	36.241	
22	328		35.0	±0.062	±1.14	3.26	51.1	1.00	2.77	34.574	35.492	36.500	
23	232		35.0	±0.073	±1.12	3.20	51.0	0.00	0.00	34.803	35.654	36.617	

TABLE LIII. The Circumference of Chest.

Age at nearest Birthday.	No. of Observations.	Unit of Measurement.	Average.	Probable Error of Average.	Probable Deviation.	Relation of Probable Deviation to Average.	Relation of Average to Height, Standing.	Absolute Ann'l Increase of Average.	Relative Ann'l Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade,	Median Minus Average.
				E	d	d/A	A/H						
15	132		30.50	±0.123	±1.42	4.65%	47.8			28.385	29.952	31.363	−0.548
16	395		31.67	±0.066	±1.33	4.20	48.0	1.17	3.83%	29.707	31.101	32.356	−0.569
17	722		32.50	±0.044	±1.23	3.78	48.5	0.83	2.62	30.770	31.895	33.034	−0.605
18	841		33.46	±0.043	±1.26	3.50	49.7	0.94	2.00	31.577	32.685	34.034	−0.775
19	750		35.00	±0.038	±1.04	3.00	51.5	1.54	4.60	32.210	33.250	34.459	−1.756
20	695		34.30	±0.048	±1.22	3.55	50.3	−0.70	−2.00	32.426	33.588	34.724	−0.712
21	493		34.30	±0.052	±1.16	3.40	50.0	0.00	0.00	32.500	33.656	34.803	−0.644
22	328		34.35	±0.065	±1.18	3.43	51.8	0.05	0.02	32.642	33.776	34.891	−0.574
23	232		34.80	±0.079	±1.20	3.45	50.7	0.45	1.40	32.751	33.873	34.850	−0.927

TABLE LIV. The Lung Capacity.

Age at nearest Birthday.	No. of Observations.	Unit of Measurement.	Average.	Probable Error of Average.	Probable Deviation.	Relation of Probable Deviation to Average.	Relation of Average to Height, Standing.	Absolute Ann'l Increase of Average.	Relative Ann'l Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average,
				E	d	d/A	A/H						
15	132		183	±2.303	±26.10	14.2%	40.9			152.4	178.2	202.2	−4.8
16	395		395	±1.091	±21.69	10.8	32.9	18.0	10.0%	176.5	193.5	217.8	−7.5
17	722		722	±0.820	±22.00	10.1	33.0	16.0	8.0	187.3	208.8	233.6	−8.2
18	841		841	±0.782	±22.87	10.1	34.0	9.0	4.1	197.9	219.0	240.8	−7.0
19	750		750	±0.642	±19.60	8.2	28.8	14.0	6.2	208.2	228.3	248.2	−11.7
20	675		675	±0.834	±21.19	8.8	30.8	−1.0	−0.4	211.3	233.2	255.3	−5.8
21	483		493	±0.940	±20.84	8.6	30.2	2.0	0.84	213.2	232.2	253.6	−8.8
22	328		328	±1.150	±20.83	8.5	30.4	5.0	2.08	218.5	237.9	259.2	−8.1
23	232		232	±1.250	±16.05	7.9	27.8	−4.0	−1.62	216.2	236.3	259.8	−5.7

TABLE LV. The Circumference of the Waist.

Age at nearest Birthday.	No. of Observations.	Unit of Measurement.	Average.	Probable Error of Average.	Probable Deviation.	Relation of Probable Deviation to Average.	Relation of Average to Height, Standing.	Absolute Ann'l Increase of Average.	Relative Ann'l Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.
				E	d	d/A	A/H						
15	132		25.09	±0.095	±1.09	4.34%	3.93			23.79	25.12	26.23	+ 0.03
16	395		26.00	±0.052	±1.03	4.00	3.94	0.91	3.63%	24.76	25.77	27.01	− 0.23
17	722		27.36	±0.042	±1.13	4.13	4.08	1.36	5.28	25.35	26.45	27.69	− 0.91
18	841		27.90	±0.044	±1.30	4.66	4.14	0.54	2.00	25.98	27.22	28.40	− 0.68
19	750		28.60	±0.044	±1.21	4.23	4.21	0.30	1.08	26.31	27.60	28.76	− 1.00
20	695		28.62	±0.052	±1.33	4.64	4.17	0.02	0.07	26.51	27.98	29.20	− 0.64
21	493		28.68	±0.062	±1.38	4.81	4.18	0.06	0.21	26.38	27.67	29.23	− 0.99
22	328		28.80	±0.070	±1.28	4.48	4.21	0.12	0.41	26.50	27.81	29.17	− 0.99
23	232		29.20	±0.093	±1.42	4.86	4.25	0.40	1.40	26.71	27.89	29.47	− 1.31

TABLE LVI. The Span of Arms.

Age at nearest Birthday.	No. of Observations.	Unit of Measurement.	Average.	Probable Error of Average.	Probable Deviation.	Relation of Probable Deviation to Average.	Relation of Average to Height, Standing.	Absolute Ann'l Increase of Average.	Relative Ann'l Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.
				E	d	d/A	A/H						
15	36		63.90	±0.130	±1.18	1.84%	100.0			62.89	64.50	66.51	+ 0.60
16	110		67.33	±0.091	±1.81	2.69	102.1	3.43	5.37	64.98	66.80	68.57	− 0.53
17	225		68.00	±0.064	±1.74	2.56	101.1	0.77	1.14	66.15	67.90	69.75	− 0.10
18	245		68.25	±0.060	±1.75	2.53	102.8	1.25	1.83	66.65	68.55	70.30	− 0.70
19	200		70.12	±0.062	±1.72	2.45	103.3	0.80	1.15	67.25	69.03	70.87	− 1.09
20	165		70.10	±0.072	±1.85	2.64	102.2	−0.02	−0.03	67.56	69.40	71.45	− 0.70
21	103		70.67	±0.076	±1.68	2.37	103.1	0.57	0.81	68.51	69.93	71.64	− 0.74
22	68		70.20	±0.108	±1.98	2.81	102.5	−0.47	−0.66	67.62	69.60	71.75	− 0.60
23	46		71.00	±0.093	±1.42	2.00	103.4	0.80	1.14	68.93	69.93	71.56	− 1.07

TABLE LVII. The Right Hand Squeeze.

Age at nearest Birthday.	No. of Observations.	Unit of Measurement.	Average.	Probable Error of Average.	Probable Deviation.	Relation of Probable Deviation to Average	Relation of Average to Height, Standing.	Absolute Ann'l Increase of Average.	Relative Ann'l Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.
				E	d	d/A	A/H						
15	36		61.0	±0.800	±9.12	15.0	95.4%			49.5	60.0	69.1	−1.0
16	110		71.5	±0.367	±7.30	10.2	108.0	10.50	17.20%	60.5	68.0	75.0	−3.5
17	225		77.5	±0.273	±7.33	9.0	115.6	5.97	8.30	68.0	75.2	82.6	−3.27
18	245		81.0	±0.245	±7.11	8.1	120.3	3.53	4.50	69.2	77.5	84.8	−3.5
19	200		85.0	±0.274	±7.52	8.8	125.2	4.00	5.00	74.2	82.0	89.8	−3.0
20	165		77.0	±0.316	±8.03	9.2	127.0	2.00	5.00	76.2	83.8	92.5	−3.2
21	103		88.0	±0.365	±8.11	9.2	128.3	1.00	2.30	77.6	85.8	94.7	−2.2
22	68		86.5	±0.449	±8.14	9.4	126.5	−1.50	−1.70	74.7	85.0	91.8	−1.5
23	46		86.6	±0.421	±6.42	7.6	126.2	0.10	0.10	81.2	89.0	96.5	+2.4

TABLE LVIII. The Left Hand Squeeze.

Age at nearest Birthday.	No. of Observations.	Unit of Measurement.	Average.	Probable Error of Average.	Probable Deviation.	Relation of Probable Deviation to Average.	Relation of Average to Height, Standing.	Absolute Ann'l Increase of Average.	Relative Ann'l Increase of Average.	25 Percentile Grade.	Median or 50 Percentile Grade.	75 Percentile Grade.	Median Minus Average.
				E	d	d/A	A/H						
15	36		60.0	±0.790	±9.06	15.1	94.0%			46.3	56.4	62.1	−3.6
16	110		70.0	±0.368	±7.31	10.4	106.2	10.0	16.6%	56.3	65.0	70.3	−5.0
17	225		76.6	±0.274	±7.43	9.7	114.3	6.6	9.1	66.6	73.5	81.0	−3.1
18	245		80.0	±0.250	±7.22	9.0	119.0	3.4	4.4	67.7	75.0	82.2	−5.0
19	200		83.0	±0.273	±7.43	9.0	122.2	3.0	3.8	72.6	81.5	87.8	−1.5
20	166		85.0	±0.322	±8.19	9.6	124.0	2.0	2.4	73.9	82.0	92.0	−3.0
21	103		97.4	±0.327	±7.26	8.3	127.4	2.4	2.8	77.2	84.5	91.8	−2.9
22	68		85.8	±0.463	±8.40	9.8	125.3	−1.6	−1.8	74.5	83.8	91.9	−2.0
23	46		84.7	±0.466	±7.10	8.3	123.3	−1.1	−1.3	78.8	85.0	90.9	+0.3